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TYROGLYPHOIDEA [ACARI]

by

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PREFACE

The enormous amount of damage to agriculture caused by the granary mites has intensified the research on these arachnids which is being carried out in the institutions of this country. This research has been greatly retarded owing to the absence of knowledge of the systematics of this group and the complete lack of a monograph. On account of this it was decided to include such a monograph in the series of books on the fauna of the U.S.S.R., the task being entrusted to the author. The material for this work on the families Tyroglyphidae, Saproglyphidae and Glycyphagidae was collected by the author during three years' work on the systematics of the group; a large collection was also built up in conjunction with E.M. Boulanova in the entomotogical section of the Zoological Institute of the Academy of Science (ZIN), and material was also obtained from the Moscow Zoological Museum and the private collection of N.N.Phillippov. Use was also made of the acarological collection of ZIN, which contained only a few dozen slides of representatives of the above families; in all some 3,000 preparations were studied.

When writing this work, it was found necessary to rearrange all the previous systematic work, and a start was made by considering the differences in characters between the various species and genera, and from these building up a classification. A detailed study was made of a large number of characters which had not been used in the past (e.g. the chaetotaxy of the body and legs, the structure of the first nymphal stage, the peculiarities in development of a series of characters, etc.). After applying the principles on which a natural system of classification is based, and by a careful analysis of the relationship between different characters, it became necessary to change the existing classification compiled by Oudemans, based on unrelated single characters which he considered to be of fundamental importance. Hence the type of description given here differs basically from pre-

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viously accepted standards and has resulted, in many cases, in a change in importance of certain taxonomic groupings, and within these groupings many alterations have been made. In order to avoid confusion between the literature of the past and this work, special attention has been paid to synonomy, and in every case reference has been made to descriptions given by earlier authors and their results interpreted in the light of modern systematic method.

Owing to the rather scanty knowledge of species of Tyroglyphidae detriticolae of this country (which is now in advance of other countries), all the Palearetic species have been included which have not yet been found here - the experience of the last few years indicates that a great number of them will, in time, be found in the U.S.S.R.; by their inclusion the work is made more complete and serves as a basis for further research on the systematics of this group of mites.

This book was written in the State University of Moscow from 1935-36; all the drawings and copies of drawings were made by me and the summary prepared by Yazikova. I would like to express my gratitude to the many colleagues who have helped to compile this work.

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General Characters of the Tyroglyphoidea

The families Tyroglyphidae, Saproglyphidae and Glycyphagidae which are considered in this work, belong to a vast group - the Acaridiae - of the suborder Sarcoptiformes; together they form a compact group - the Tyroglyphoidea detricolae - corresponding to the former family of Tyroglyphidae with the exclusion of the Anoetidae. The representatives of this group are characterised by the following basic characters, the combination of which distinguishes them from other related Acaridiae. The mouth parts are of a chelate type, the chelicerae having toothed edges on both movable and fixed limbs. The pedipalps are without platelike outgrowths and without whiplike apical setae; the skin is smooth, granular or, more seldom, covered with little projections or with narrow, more or less parallel, striations. The genital opening of the ♀ is in the form of a ventrally placed longitudinal slit which is completely separate from the anal. Most species have genital 'suckers' and ventral ringlike organs are absent. The tibia of at least the two anterior pairs of legs each bears dorsally a long seta. The ambulacrum consists of a more or less well-developed membranous praetarsus and of a single, hooklike claw. Most species are free-living and saprophytic, but wide use is also made of an epizoic form of life; this is usually brought about by means of the hypopus which differs markedly in structure from the other stages of development.

External Structure of the Adult Stage

The body of a tyroglyphid mite, like that of all other mites, consists of two regions - the gnathosoma bearing the complex of mouth parts, and the idiosoma with its four pairs of walking legs (fig. 1).

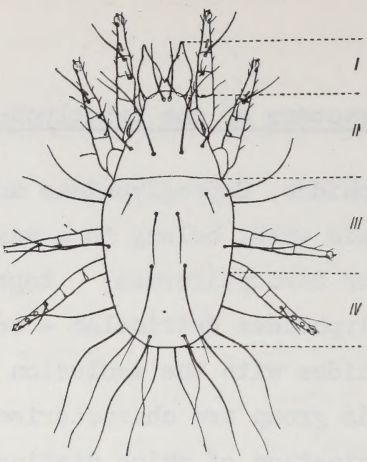
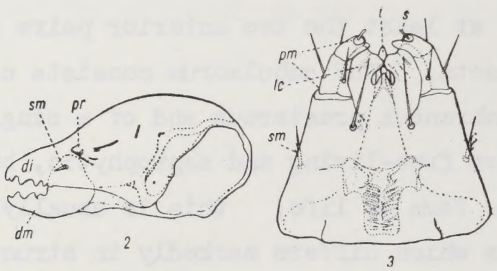


Fig. 1. Tyrolichus casei Ouds, ♂ dorsal

I - gnathosoma; II - propodosoma; III - metapodosoma; IV - opisthosoma; I + II + III - proterosoma; II + III - podosoma; II + III + IV - idiosoma; III + IV - hysterosoma.



Figs. 2-3. The structure of the gnathosoma of Tyroglyphus farinae L.

Fig.2. Lateral view of right chelicera (internal aspect): l - basal segment; d i - digitus fixus; d m - digitus mobile; p r - conical process; s m - mandibular spine.

Fig.3. Ventral view of hypostome: p m - pedipalp; s - apical sensilla of pedipalp; l c - coxal lobe of pedipalp; l - lingua; s m - maxillary seta.

Gnathosoma (fig. 2). This is relatively small, compact and, in most cases, free. Only in a very few forms (e.g. some Labidophorinae) is it concealed in a separate depression - the camerostome - beneath the anterior edge of the idiosoma (which then protrudes forward like a hood). The gnathosoma is very mobile and capable of being partially retracted within the body, it is composed of a pair of stout chelicerae, beneath which is an unpaired structure or hypostome. This is formed by the fusion of the basal parts of the pedipalps with the elements of the hypopharynx. The chelicerae lie in the longitudinal axis of the body, they are laterally compressed and consist of a large, more or less egg-shaped, basal segment, the front of which is produced into a massive projection - the so-called fixed digit - and a freely articulated distal segment - the digitis mobilis - which forms a pincer with it. The inside cutting edges of both fingers of the pincer are armed with strong teeth, often of elaborate arrangement. On the internal surface of the basal segment of the fixed digit, there is usually a humplike protrusion - the so-called conical appendage - which is sometimes divided at the end. Lying in front and ventral to it is a small mandibular spine. The shape, proportions and relative sizes of the chelicera, the character of the toothed edge of the blades, and in some genera (e.g. Tyrophagus), the structure of the conical protrusion and mandibular spine are widely used in the systematics of the Tyroglyphoidea. The hypostome (fig. 3) is a trapezoid plate of a fairly complicated structure, which has probably been formed by the fusion of the basal segments or coxae of the pedipalps with the hypopharynx; in the Tyroglyphoidea, its structure has not been closely studied and is not fully understood. To the lateral anterior edges of the hypostome are joined the maxillary palps, formed by the free distal segments of the pedipalps and consisting of two somewhat flattened segments; of these the distal segment is bent medially at an obtuse angle to the proximal and terminates in a rounded flat plate, bearing in the middle a rodlike sense organ. The latter is sometimes regarded as the rudimentary third segment of the pedipalp, i.e. a tarsus, the tibia and

genu being represented by the first and second segments of the pedipalp. In addition to this sense organ, two pairs of setae are present on the first segment and one pair on the second. On the hypostome, there are another two pairs of setae, one pair near the midline on the ventral surface, and one (the so-called maxillary spine) on the dorsal side of its lateral edges. The structure of the maxillary spine is, in some genera of Tyroglyphidae (e.g. Tyrophagus, Caloglyphus), a fairly good systematic character.

Idiosoma. In some species (e.g. most of the Glycyphagidae) the idiosoma is not divided into segments, in other species (e.g. all of the Tyroglyphidae and Saproglyphidae), it is clearly divided by a transverse groove passing behind the bases of legs II and dividing the body into an anterior conical part (the propodosoma) which bears the complex of mouth parts (the gnathosoma) and two pairs of walking legs, and a larger posterior part from which arise legs III and IV. A further subdivision of hysterosoma into metapodosoma and opisthosoma, devoid of appendages, has not been observed in the Tyroglyphoidea. No signs of segmentation, in the form of transverse grooves (except for the division between propodosoma and hysterosoma) or metamerically placed shields, spots and sculpturings, have been observed, and traces of such are only indicated by the nature of the distribution of the dorsal setae; these have a tendency to be arranged in transverse rows. By studying the position of these setae and that of the appendages, the body of the sexually mature tyroglyphid mite can be said to consist of thirteen fused segments: five proterosomal (acron + two segments bearing mouth parts + two segments with the first two pairs of legs) and eight hysterosomal (the two posterior leg-bearing segments + six abdominal or opisthosomal). This idea, however, requires support from a study of comparative anatomy and embryology.

The general shape of the idiosoma is not constant. The relationship between its length and width varies in different species from

1.2:1 (some Sennertia sp:) to 3 - 3.4:1 (species of the genus Monieziella); it is sometimes spherical sometimes cylindrical or more or less flattened in a dorso-ventral plane. Typically it is oval and elongated, the ratio of length to width being 1.7 - 1.8:1. In life the dorsal surface of the idiosoma is seldom regularly arched, usually its outline is more or less subdivided by two longitudinal cervical depressions on the propodosoma (or on the anterior part of the undivided idiosoma), and by a pair of often S-shaped, longitudinal (rachidial) grooves on the hysterosoma. These divide the surface of the latter into a wider medial (axial) and two lateral (pleural) fields. The degree of indentation of these grooves and the elevation of the fields marked off by them, not only differ in different species, but also vary considerably in the same individual, depending on its physiological condition (i.e. they are almost absent in females distended with eggs, but become more pronounced during dehydration due to drier surroundings). On mounted preparations, these grooves become invisible and the longitudinal division of the idiosoma into three regions completely disappears. (Note[1] In some of his works 1926-32, A.C. Oudemans considered the presence of these rachidial grooves as an important character of a species, the grooves having been seen accidentally on some slides).

Cuticle. In the majority of the Tyroglyphoidea, the cuticle is colourless, thin and of a soft membranous consistency. In all Saproglyphidae and all Tyroglyphidae, it is smooth and gives the living mites a glossy appearance. In Glycyphagidae the cuticle is thin, rough or covered with thornlike micro-projections, and its surface is only completely smooth in species with a more thickly cuticularised skin (Chortoglyphus, Fusacarus, etc.). A striated skin is exceptional (Aëroglyphus, Calvolia hebeclinii, C. tuberculata, ♂ of Winterschmidtia); when present, it is thin and is different from that found in the parasitic Acaridiae. In some Glycyphagidae, the skin is more or less thickly cuticularised, giving rise, in some cases, to a complete hard

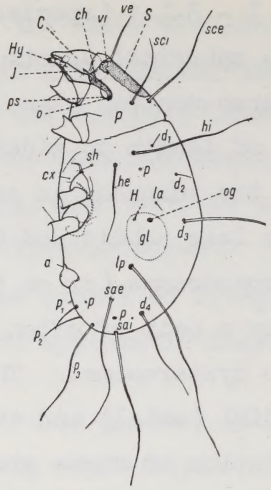
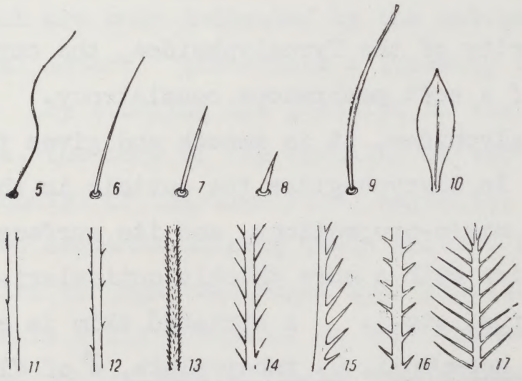


Fig.4. Forcellinia fungivora Ouds, lateral view of ♂ (distal segments of legs are not shown)

Position of shields, setae and glands, etc. Setae: vi - internal vertical; ve - external vertical; sce - external scapular; sci - internal scapular; hi - internal humeral; he - external humeral; sh - sub-humeral; d_1 - first dorsal; d_2 - second dorsal; d_3 - third dorsal; d_4 - fourth dorsal; la - anterior lateral; lp - posterior lateral; sae - external sacral; sai - internal sacral; cx - coxal; a - first anal; p_1 - first postanal; p_2 - second postanal; p_3 - third postanal; S - propodosomal shield; ch - sclerite above base of leg I; J - Grandjean's organ; ps - pseudostigmatic organ; o - opening of coxal gland (pseudostigma); gl - fat or latero-abdominal gland; og - its opening; p - pore; C - chelicera; Hy - hypostome; P - propodosoma; H - hysterosoma.



Figs. 5 - 17. Various types of setae found on the idiosoma.

Fig.5 - capilliform or hair-like; fig.6 - bristle-shaped; fig.7 - pointed or needle-shaped; fig.8 - spine-shaped; fig.9 - flattened or ribbon-shaped; fig.10 - leaf-shaped or lanceolate; figs.11 - 17 various types of pectinate, serrated and bi-pectinate setae.

covering (conscutum) which covers the whole, or almost the whole, idiosoma (Fusacarus, Chortoglyphus, Xenoryctes, Gohieria), it is then an intense dirty brown or ginger colour. In those species which have a soft membranous skin, the thickening and hardening of separate parts leads to the formation of more or less clearly defined plates; thus on the dorsal surface of the propodosoma is often found a plate (scutum propodosomatale), probably homologous with the propeltidium of Arachnids. In the Tyroglyphidae and Saproglyphidae it is shaped like a broad parallelogram or shield, and occupies the greater part of the surface of the propodosoma anterior to the scapular spines; it is almost completely colourless. (Its outlines can only be clearly seen in well-illuminated preparations). When present in the Glycyphagidae, the propodosomal plate is more varied in shape and smaller, and in the subgenus Glycyphagus (of the genus Glycyphagus), is represented by a narrow, elongated, dark strip (crista metopica). It is reminiscent of the single shield found in the Parasitengona (Trombidiformes). In those species where the cuticle is thick and coarse (some species of Schwiebia - Tyroglyphidae), the propodosomal shield becomes indistinguishable from the surrounding skin and loses its independent character. The second dorsal or opisthosomal shield (scutum opisthosomotale) is found only in males of some of the Rhizoglyphinae (Schwiebia, Monieziella, Histiogaster) where it covers the posterior half of the hysterosoma in a way that is characteristic of these species. In addition to these plates, similar but less constant shield-like formations are often met around the elements of the coxal skeleton - the coxal-sternal skeleton - and above the bases of anterior legs. In the females of some Tyroglyphidae there is sometimes a small genital shield which is feebly cuticularised and in the centre of which is the copulatory opening.

The setae of the idiosoma (figs. 4, 27, 41, 46). On the dorsal and lateral surfaces of the idiosoma, are seven to twenty pairs of symmetrically placed setae, arranged in six groups. (1) Vertical setae - v e, v i (setae verticales) consist of one or two pairs (absent only in species

of Monieziella) which are the nearest to the anterior end of the idiosoma. (2) Scapulars - (setae scapulares - sc) one or two pairs forming a transverse row across the dorsal surface of the propodosoma (or in a corresponding position in species with an undivided idiosoma). (3) Humerals - (setae humerales - h e and h i) consisting of one to three pairs of setae situated in the shoulder region, in the anterior corners of the hysterosoma or on corresponding humeral protrusions; one or two pairs of the setae occupy a marginal position. (4) A group of four pairs of dorsal setae (setae dorsales - d_1 to d_4) arranged in two longitudinal rows down the middle of the back. (5) One to three pairs of lateral setae (setae laterales - l a) placed on the edges of the body or near the edges in the posterior half of the hysterosoma. (6) One to two pairs of lumbar setae (setae sacrales - sa) grouped along the posterior end of the idiosoma. The position of most of these setae varies considerably, but within such limits that one is able to recognise homologous setae in the different species. The length of the setae varies considerably, from microsetae 1 to 2% of the idiosoma in length and only visible at high magnifications, to those macrosetae which are very long and exceed the length of the idiosoma by 2 - 3.5 times. At the same time, the degree of change in length is not the same for the different pairs of setae. Thus some (e.g. v i or sc e) are fairly constant in length, whereas others vary within wide limits. In connection with this, the relation between their lengths is also very variable, but, as a rule, the setae increase in length towards the posterior end of the idiosoma. The structure and form of the setae themselves is also by no means constant and extremes of structure can be related to one another. They can be classified as follows - (1) hairlike, thin and flexible, not thickened towards the base (fig. 5); (2) simple, of normal type, differing from (1) by a more or less visible increase in diameter towards the base, and by being stiffer (fig. 6); (3) needle-shaped, very hard and massive, becoming gradually pointed at the end (fig. 7); (4) spine-shaped, more or less conical, usually of small size (fig. 8); (5) flattened or

ribbon-shaped of relatively small width, the flattening being dorsal (fig. 9); (6) leaflike or scale-shaped, or taking the form of wide plates of varying shapes (fig. 10). The setae of the first three types are either smooth or ornamented with secondary protrusions of widely differing sizes and distribution. They can be classified according to the length or thickness of the pectinations as follows - (1) with lateral teeth, small and widely spaced; (2) short thinly pectinate setae of narrow gauge and covered with short, thin barbs; (3) with barbs thickly distributed; (4) coarse pectinations which have secondary protrusions, relatively long and thin and arise from both sides of the rachis; (5) comblike, with rigid protrusions placed only on one side; (6) with strong barbs arising from both sides.

When flattened in shape the setae are either coarsely or finely pectinate, the scalelike setae tend to be thickly pectinate, whilst the spinelike ones are always smooth. In most cases the setae of the dorsal side of the idiosoma project perpendicularly or at an acute angle to its surface. The variation in length is very great in the different species of mite and bears a certain relation to their conditions of life; these setae evidently have a sensory function, playing the part of an organ of orientation in the spaces between the particles of substrate in which the mites live. A very important biological part is played by these setae in determining the surface area of the body, and correspondingly their capacity for distribution by air currents, which greatly affects their powers of dispersal. The structure, size and position of the above described setae are of systematic importance, and are widely used in classification. When their length is calculated, it is usually given as a percentage of the length of the idiosoma.

The chaetotaxy of the ventral surface of the idiosoma is much sparser than that of the dorsal and usually consists of short, uniform, more or less hairlike setae; two pairs (s. coxales - cx) are placed on the corresponding coxal fields I and III; one subhumeral pair

(s. subhumerales - sh) arises below the shoulder; three pairs of fine genital setae (s. genitales) are grouped around the genital opening; the anal complex often consists of two distinct groups - the preanal (s. preanales - pr a) consisting of one to two pairs of setae, and the postanal (s. postanales - p) of from one to five pairs. The number, distribution and structure of coxal, subhumeral and genital setae are very constant within the group, whilst the setae of the anal complex are fairly variable, both in number and distribution (they differ in both sexes) and provide a series of good systematic characters.

Cup-shaped organs. On the hysterosoma are to be found four pairs of pore formations, one pair near the humeral setae, one near the front pair of lateral setae, one at the posterior end of the body and one on either side of the anus. These structures are sense organs homologous with the slitlike organs of other Arachnida.

Grandjean's organ (Klemmorgane) - The Tyroglyphidae and many Saproglyphidae have peculiar cuticular protrusions - sometimes called 'cheek organs' - on the lateral surfaces of the propodosoma (fig. 4). In most cases they appear as a pair of linear plates which envelop the lateral base of the gnathosoma and have their apices directed anteriorly or in an internal, posterior direction. In the Rhizoglyphinae Grandjean's organs are simple, often covered with fine pectinations, in other Tyroglyphinae they are more complicated in shape, e.g. in Tyroglyphus farinae they are fan-shaped and terminate in very fine free serrated lobes (figs. 111, 115, 117, 118).

Pseudostigmatic organ. Situated above the base of leg I on the propodosoma, is a pseudostigmatic seta (fig. 4 ps), this is a more or less modified seta, varying considerably in shape. In some species it is simple and rodlike, in others thickened and featherlike at the edges; the greatest complexity is reached in the Glycyphaginae, where it has the shape of a much branched twig. The pseudostigmatic organ of the Tyroglyphinae is not homologous with structures of the same name found

in the Oribatei and Trombidiformes.

Glands. At the base of the pseudostigmatic organ, many species have a small slitlike opening surrounded by an elliptical cuticularised ring - the so-called pseudostigma (fig. 4 ♂) - many authors have interpreted this slit as a real stigma and have even tried to show that a tracheal trunk emerges from it, but the investigations of E.G. Becker have established that it is nothing but the opening of the coxal glands (see anatomical part).

The openings of the fatty glands - found on the hysterosoma between the anterior and posterior lateral setae - have a similar structure, the glands themselves have the appearance of large, baglike formations on the sides of the hysterosoma towards its posterior end, which are filled with a secretion which refracts light very strongly, (they often acquire a dark colour in microscopic preparations).

Anal opening. (anus - a). This is a ventrally placed longitudinal slit, usually terminal and sometimes considerably removed from the posterior edge of the body. In most cases it is identical in the two sexes, but in the Tyroglyphidae its position differs in ♂ and ♀.

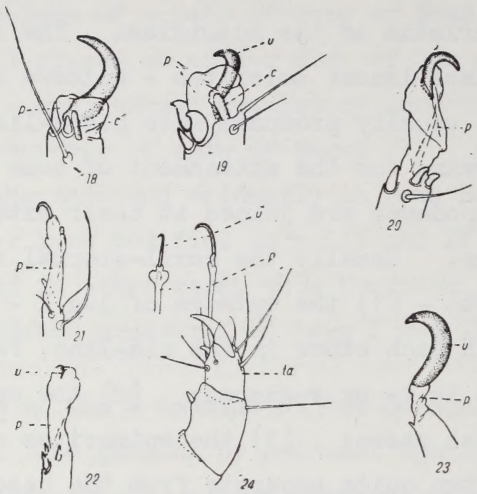
The basal part of the external genitalia is a copulatory organ or penis (p). This lies in a genital slit - ag - in a special groove, partly concealed by overhanging folds of cuticle, and situated between the bases of legs III and IV, or more or less behind them or, exceptionally, between legs I (Chortoglyphus). The penis usually consists of a stiff tube associated with a series of apodemes to which the muscles governing its movement are attached, its stylet-like end varying in size and shape; in addition there are one or more supporting sclerites which surround the penis and also, occasionally, a rather large chitinous platform - the epiandrium (fig. 48 epa) - placed at the anterior end of the genital opening. At the sides of the penis, inside the genital groove, are usually placed two pairs of genital 'suckers' of varying shapes (pg); these can be protruded outside the genital opening and

are sense organs (chemoreceptors). Associated with the copulatory organs in many groups are special organs of fixation. Among the Tyroglyphidae - with the exception of the genera Scatoglyphus, Pontoppidania (Saproglyphidae) and Chortoglyphus (Glycyphagidae) - this adhering apparatus consists of a pair of more or less large, anal copulatory suckers (da) placed on either side of the anal slit, and two (in Pontoppidania - one) tarsal copulatory suckers (dt) projecting from the external surface of each of tarsi IV. In the males of the sub-family Labidophorinae and evidently in some Saproglyphidae (Nanacarus) the more or less modified legs III and IV function as an adhering apparatus, and in other cases this function is fulfilled by the correspondingly widened praetarsi of legs I and II.

The external genitalia of the ♀ consist of two openings widely separated from one another. The genital or oviducal opening (figs. 26 g and 47 ge) is a longitudinal slit placed between epimeres III and IV, sometimes it is much more anterior in position, its anterior end beginning immediately behind epimeres I or, more rarely, further back. In most species the genital opening is covered by a pair of more or less well-developed genital folds, which often meet in the midline anteriorly and gradually diverge behind; in some of the Glycyphagidae there is a third unpaired fold which closes the genital opening from the back. Beneath the genital folds are two pairs of genital 'suckers' which have the same structure as in the ♂. In the majority of the Saproglyphidae and Glycyphagidae, the anterior edge of the genital opening is strengthened with a crescentic sclerite - the epigynium - which is absent in the Tyroglyphidae. Sometimes the epigynium unites with the sternum, with a special cuticularised circumgenital ring which surrounds the opening of the oviduct, or with the epimeres of legs III. The copulatory tube - ac - is usually terminal, posterior to the hind end of the anal slit; in some species it is represented by an indistinct rounded pore, but in others it is indented to form a cylindrical or conical tube (the so-called bursa copulatrix) which is posteriorly

or obliquely directed towards the ventral side (fig. 46 bc).

The coxal-sternal skeleton. As usual, the legs consist of six segments, but their basal segments (coxal) have become greatly modified and immovably fused with the idiosoma, thus forming the coxal-sternal skeleton so characteristic of the Acaridiae. The skeleton consists of narrow, more or less linear sclerites - epimera and epimerites - of which the former are usually produced into plate-like apodemes embedded in the body, and serving for the attachment of some of the muscles which move the legs, the apodemes are joined at their external ends with the acetabula of the legs. Usually the coxal-sternal skeleton consists of the following elements - (1) the epimera of leg I - (ep I) - in most cases these fuse with each other in the mid-line, forming an unpaired sternum - st - which is v- or y-shaped; (2) the epimera of legs II - (ep II) - free in most cases; (3) the epimerites of the second pair of legs (et II) - often quite separate from the base of legs II; (4) the epimera of legs III (ep III) and (5) the epimera of legs IV (ep IV). These are connected by their external ends with the anterior edges of the acetabula of the corresponding pair of legs, and in most cases have free internal ends. Sometimes the epimerites of legs III and IV are also developed, diverging from the posterior edges of their acetabula. In some species the spaces between the epimeres (coxal fields) are numbered according to the epimeres which encircle them anteriorly. These spaces can be more or less densely cuticularised, forming coxal shields (fig. 551) similar to those found in the ticks and species of other suborders (e.g. Trombidiformes). In those cases where the epimeres form a thickened anterior, and the epimerite a thickened posterior edge of the shield, the point at which the coxa begins to be modified and finally divided into the above-mentioned elements can be clearly seen. (However, in this case it is rather a secondary formation of coxal fields, as the result of a thickening of the surface of corresponding coxal fields.)



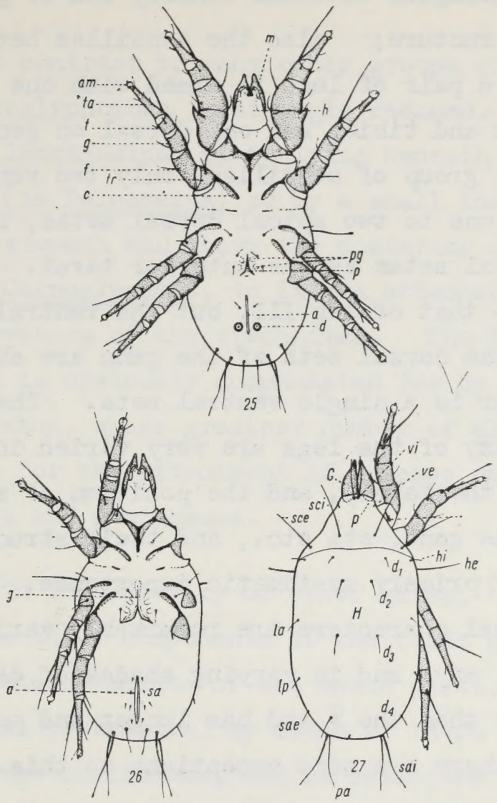
Figs.18 - 24. Types of ambulacrum

Fig.18 - Histiogaster bacchus, sp.n. Fig.19 - Aleuroglyphus ovatus Troup. Fig.20 - Carpoglyphus lactis L. Fig.21 - Xenocastor fedjushini, sp.n. Fig.22 - Glycyphagus destructor Schrank. Fig.23 - Sennertia cantabrica, sp.n. Fig.24 - Leg I of Hyadesia fusca Lohm. (after Lohmann). Abbreviations: ta - tarsus; p - praetarsus; u - claw; c - connecting sclerites.

Legs. Owing to the modification of the coxa, the free part of the leg consists of only five segments - (1) trochanter, (2) femur, (3) genu, (4) tibia, (5) tarsus. The tarsus terminates in an ambulacrum, consisting of a more or less well developed and membranous praetarsus and a usually unpaired claw (ungulum), the structure of the ambulacrum providing a good character for the larger taxonomic categories. In some groups the claw is articulated with the end of the tarsus by means of connecting sclerites (c), forming with the claw a dicondyle joint; in such cases the praetarsus is large and fleshy and envelops the base of the claw. In others the claw is stalked (figs. 20-24), i.e. it is inserted on the distal end of the elongated praetarsus and is not directly connected with the tarsus; at the same time, it is often considerably reduced and can only be seen with difficulty (and in Nanacarus is absent altogether); alternatively, the claw may be very large and the praetarsus then appears as a short stalk supporting it. The proportions of the legs and of the separate segments vary considerably and it is possible to distinguish several basic types of structure - (1) the fossorial type - which is clearly shown by Rhizoglyphus and Schwiebia - is characterised by the extraordinarily powerful development of the anterior legs, which are provided with large conical spines, the development of the posterior ones being relatively feeble; (2) the walking type - widely distributed among Tyroglyphidae and characterised by slender legs of medium length; (3) the cursorial type - in which the tarsi are much elongated - is most strikingly illustrated by the genus Glycyphagus. The shape of the segments also varies greatly, although in general each is shaped like a somewhat laterally compressed cylinder, with the exception of the end of the tarsus which distally becomes narrower. In their general plan of construction, legs I and II are very similar, but they differ considerably from the posterior pair which are almost identical in structure. An exception to this rule is found in cases where there is a marked hypertrophy of legs I (♂ of Tyroglyphus) and legs III (heteromorphic ♂ of the Rhizoglyphinae) which will be mentioned below.

Chaetotaxy of the legs. This is composed of a fairly large number of sensory skin organs - setae and other sensillae, often modified, each pair of legs having in this connection its own specific peculiarities. The chaetotaxy of leg I is as follows: on the trochanter and femur there is one ventral seta, on the genu are two basal setae of which one is dorsal and the other is on the external edge of the segment, and two apical placed next to each other on the dorsal surface and near the middle of the distal edge of the segment. One of these two apical setae is usually represented by a somewhat short, blunt, olfactory rod (figs. 93, 456), the other has a normal structure, but is absent in some forms (Chortoglyphinae). The tibia has three setae - the dorsal apical one which is very large and always smooth - and two ventral ones. The chaetotaxy of tarsus I is considerably richer and more complicated than that of the preceding segment, it consists of three groups of sensillae - basal, median and apical. The basal group consists of a sensory rod - alpha - placed dorsally at the base of the tarsus; at its base is a more or less orb-shaped beta which is complementary to alpha and arises from the same chitinous depression (this is absent in a number of species), another two sensillae - delta and gamma - are external to alpha, gamma being usually rodshaped. The medial group of setae is situated in the middle of the tarsus, but may be displaced nearer to its distal end; it consists of three or four setae, three of which are ventrally placed like the three points of a triangle, whilst the remaining one - eta - is dorsal or on the internal surface of the tarsus; in some species sensilla eta is more proximal in position, arises immediately in front of the sensory rod alpha and is thornlike in shape (figs. 196, 198, 199). The apical group consists of three or four dorsal apical setae - in most cases hairlike - and three to five small ventral spines (in Tyroglyphus only one) which encircle the base of the ambulacrum. In many species of the family Tyroglyphidae, there is, in addition, a small dorsal apical spine on the external side of the base of the claw.

The chaetotaxy of leg II is similar to that of leg I in every respect, except that the apex of the genu has only one instead of two



Figs. 25 - 27

Fig.25 - Tyroglyphus farinae L, ♂ , ventral surface: m - chelicera; h - hypostome; p g - genital 'suckers'; p - penis; a - anus or anal slit; d - anal copulatory suckers; a m - ambulacra; ta - tarsus; t - tibia; g - genu; f - femur; tr - trochanter; c - coxa (epimere). Fig.26 - T. farinae L, ♀ ventral surface: a - anal slit; g - genital opening; s a - anal setae; Fig.27 - T. farinae L, ♀ dorsal surface: G - gnathosoma; P - propodosoma; H - hysterosoma; setae: v i - internal vertical, v e - external vertical, sc i - internal scapular, sc e - external scapular, h i - internal humeral, h e - external humeral, d_1 - first dorsal pair, d_2 - second dorsal pair, d_3 - third dorsal pair, d_4 - fourth dorsal pair, l a - anterior lateral, l p - posterior lateral, sa e - external sacral, sa i - internal sacral, pa - postanal.

sensillae, which is homologous with the sensory rod of genu I, and similar to it in its structure; also the sensillae beta and delta are missing. The third pair of legs is armed with one ventral seta on the trochanter, genu and tibia, and one dorsal on genu and tibia. The tarsus has no basal group of sensillae, only two ventral setae in the middle region, and one to two apical dorsal setae, but it has the same collection of apical setae as the anterior tarsi. The chaetotaxy of leg IV is similar to that of leg III, but the ventral setae on trochanter and genu, and the dorsal seta of the genu are absent. On the other hand, on the femur is a single ventral seta. The sensillae which form the chaetotaxy of the legs are very varied in their structure, their number (on the tarsi), and the position of some, e.g. that of the basal seta of the genu, eta etc., and their structure give a series of characters of primary systematic importance.

The secondary sexual characters are remarkably varied and show themselves in different ways and in varying shades of definition. As a rule the ♂ is smaller than the ♀ and has longer and more slender legs and longer setae, but there are some exceptions to this. In some species the ♂ is represented by two types, the one - the homeomorphic phase - similar in structure to the ♀, the second - or heteromorphic phase - distinguished by the great thickening of the third pair of legs and hypertrophy of the secondary sexual characters.

A Short Survey of the Internal Structure

Only a few representatives of the group Tyroglyphoidea have, up to now, been studied anatomically - Tyrophagus longior Gervais, (Nalepa 1884); Carpoglyphus lactis L, (Nalepa 1885 and Lönnfors 1930); Hericia hericia Robin and Talpacarus platygaster Michael (Michael 1901). These investigations have revealed the general outline of the internal structure, but they are clearly insufficient for assessing the anatomical differences, which undoubtedly exist, between the separate groups

of lower taxonomic status which belong here (families, genera).

Endoskeleton. In contrast to many other groups of Acari, the endosternum in the Tyroglyphoidea is strongly reduced. Here it is represented by a small longitudinal plate lying beneath the posterior section of the oesophagus (in Talpacarus) or by a small insignificant sclerite lying beneath the stomach and above the posterior end of the oesophageal ganglion (in Carpoglyphus), to it are attached several muscles, including the depressors of the trochanter. The feeble development of the endosternum is obviously compensated for by the presence of a coxal-sternal skeleton, whose greatest number of elements have well-developed apodemes for the attachment of a large number of muscles which move the legs and gnathosoma.

Musculature. As in the majority of other mites, this consists of six basic groups. The chief components of the first group, i.e. those which bring about the movements of the mouth parts, are two systems of strong, longitudinal retractors, by means of which the gnathosoma as a whole, as well as the chelicerae, can be retracted into the body. This group of muscles almost completely occupies all the space between the oesophageal ganglia, stomach and external cuticle and is fixed dorsally in the region of the propodosomal shield. To this group also belong smaller muscles which move the gnathosoma in a rotary direction, and also those which allow it to bend down almost perpendicularly. The second group are strong, dorso-ventral muscles (m. dorso ventralis) whose points of attachment are indicated by longitudinal depressions on the dorsal surface of the body (rachidial ruts), contraction of these muscles causes flattening of the body. The shortening of the body (i.e. its contraction in a longitudinal direction) is brought about by the third group of muscles, this consists of four pairs of longitudinal muscles which run along the walls of the body from the scapular region to the surface of the third pair of legs (these muscles are absent, it seems, in some representatives of the group). To the fourth group

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belong a larger number of muscles which move the legs: they can be divided into two groups - (a) muscles which bring the legs as a whole into motion, and (b) muscles which govern the movement of the separate parts of the leg. The first of these originate from the dorsal wall of the body (m. levator trochanteris), from the endosternite (m. depressor trochanteris), the sternum and epimera II (muscles which rotate the trochanter and move it backwards and forwards); they are inserted on the proximal edge of the trochanter. The second group of leg muscles is represented by the flexors and extensors of the femur (m. flexor femoris and m. extensor femoris), genu, tibia and tarsus with its claws. The flexor of each segment extends from its base to the dorsal wall of the next segment but one (i.e. the flexor of the tarsus - from the genu, the flexor of the tibia - from the femur etc.); the shorter flexor stretches from the segment immediately preceding it; in such a way each segment of the leg contains parts of three muscles. The fifth and sixth groups of muscles form the musculature of the digestive tract and the sexual organs. These are discussed below in the corresponding sections.

The Nervous system is concentrated to form a single ganglionic mass (synganglium) - the brain - pierced by the oesophagus; the elements forming it - the supra- and sub-oesophageal ganglia and the paired oesophageal commisures are completely fused. The number of nerves leading from this mass is not completely known.

Alimentary canal. In the Tyroglyphoidea this consists of five parts - pharynx, oesophagus, stomach or midgut, colon and finally the rectum, which opens by the anus on the ventral surface of the opisthosoma. The pharynx, which is a continuation of the back of the mouth, is a flattened elastic tube functioning as a pump; this sucks up the food through the mouth and pumps it into the oesophagus. Two systems of muscles enable it to do this - five to six pairs of strong muscles dilate the pharynx radially (m. dilator pharyngis), running from the middle of its

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dorsal wall to the encircling chitinous skeleton and dilating the pharynx on contraction, and several transverse pharyngeal constrictors (m. constrictores pharyngis) are stretched between the raised lateral edges of its dorsal, gutterlike wall; these, combined with the elasticity of the wall, by their contraction cause the pharynx to bend ventrally and so close its orifice. Posteriorly, the pharynx merges with a cylindrical oesophagus, forming at its junction a valve which probably prevents the regurgitation of food into the pharynx. Having passed through the wide opening of the circumpharyngeal ring, the oesophagus expands into a spacious, somewhat triangular stomach (ventriculus) into which enter two lateral caeca. The stomach is separated by a constriction from a spherical or elliptical large intestine (colon), which itself is separated by a constriction from the rectum. This gradually widens posteriorly and terminates in a laterally flattened opening.

At the junction between colon and rectum, there enter two pairs of fairly long, tubular excretory organs; these are the malpighian tubules, whose size and shape vary in different species; in some forms, e.g. Talpacarus, they are completely absent.

Glandular system. Certain glands are associated with the digestive system of the Tyroglyphoidea; included here are the glandular regions of the internal wall of the stomach and of its blind appendages, also the small glandular formations in the thickness of the epithelium of the hind gut. The latter evidently secrete a slimy secretion which envelops the faecal mass with a very thin film (to a certain extent analogous with the peritrophic membranes formed by insects). Although not connected with the digestive tract, the coxal and 'fatty' glands are larger, their ducts opening on to the external surface of the body; consequently, they have been mentioned in the description of the external characters of the Tyroglyphoidea. The 'fatty' glands are situated, as has already been pointed out, on the hysterosoma behind the base of legs IV; they are oval, sac-like formations, lined with a flat epithelium and usually filled with a yellowish fatty secretion of high refractive index. They

are probably lubricating organs and one imagines that the thin fatty layer, which covers the body in the Tyroglyphoidea and probably prevents wetting, is formed from the secretion of these glands.

Respiratory organs. These are absent in the Tyroglyphoidea, as well as in many other Acaridiae, and respiration takes place through the skin; consequently, spiracles are absent, (the so-called pseudostigmatic slit present in many species above the base of leg I has been taken by many authors to be the real functionary spiracle (Oudemans 1932) and is in fact the exit of the coxal gland).

In females of Gohieria fusca Ouds (Labidophorinae), genital tracheae have recently been discovered, probably analogous with tracheae of the genus Cyta (Bdellidae) and other genera of the Trombidiformes, which do not possess a spiral thread; whether they have a respiratory function is not known. The Tyroglyphoidea have no closed blood system.

Male genital system. This consists of a pair of somewhat pear-shaped testes (rather ellipsoidal in Carpoglyphus) which anteriorly merge with long genital ducts, uniting to form a short ejaculatory canal. This canal is also joined by ducts from accessory glands of varying shape - one in the Tyroglyphidae and two in the Glycyphagidae, in the latter case they greatly differ from each other in their structure and shape. The structure of the penis and of the chitinous part surrounding it has already been discussed above. In addition, one should mention that the latter also serve as a point of attachment for the many muscles which govern the movement of the penis. The retractor muscles of the genital 'suckers' which originate from epimeres IV should also be mentioned.

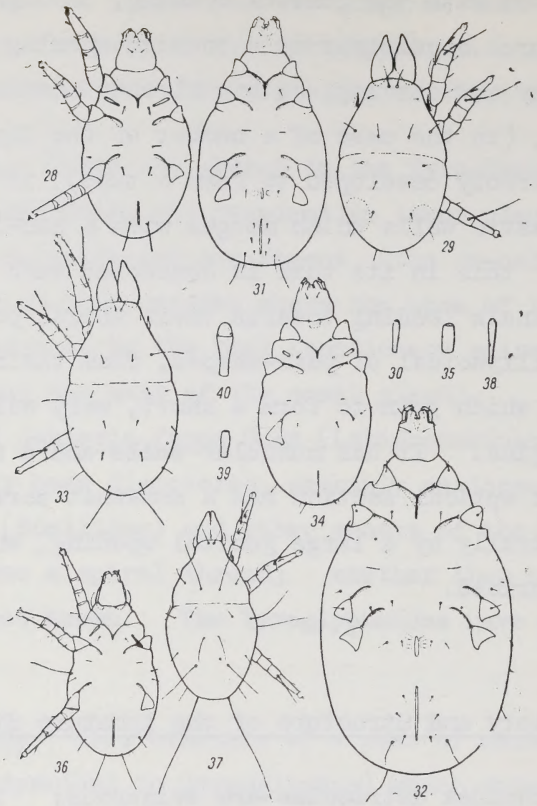
The female genital system includes the so-called bursa copulatrix - (a tube really playing the part of a vagina), a canal which joins it with the receptaculum seminis, the receptaculum itself, paired ovaries and oviducts which unite distally to form a wide common duct, and a series

of structures connected with the genital opening, through which the egg is laid. The bursa copulatrix is a rounded opening placed at the aboral end of the body and serving, as has already been mentioned, as a copulatory opening, (in the case of a number of the Glycyphagidae, its edges are considerably developed to form a tube), it leads into a narrow canal with elastic walls which merges with a sac-like, fairly large receptaculum; this in its turn is connected with the ovaries by a pair of short canals leading towards their aboral poles. The ovaries are either ellipsoidal or pear-shaped, from their oral poles emerge long oviducts which join to form a short, very wide communal duct known as the vagina. It has muscular walls and a folded chitinous lining (which in optical section has a somewhat serrated outline). The vagina opens ventrally by a large genital opening, whose structure has already been described.

The Life History and Structure of the Immature Stages

All the Tyroglyphoidea detricolae are oviparous; in some species, it is true, viviparity does occur occasionally and the larva emerges as the egg is laid, (*Tyroglyphus farinae* L, some *Tyrophagus* sp:, *Glycyphagus destructor* Schrank), but these cases are extremely rare and are more like a physiological abnormality than a biological character of the species. A similar viviparity, as well as the habit of egg laying, is shown by some species of *Caloglyphus* (Trouessart 1897); in the case of *C. moniezi*, the development of the embryo in the body of the ♀ can proceed up to the formation of the protonymph, or even the hypopus.

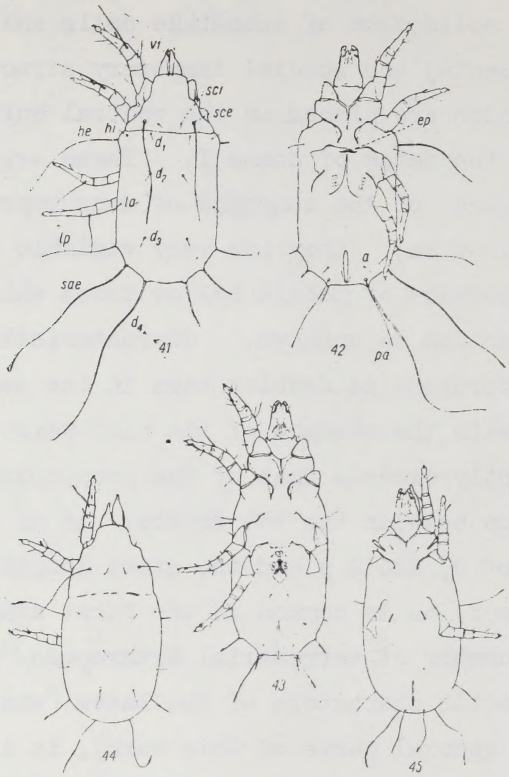
Postembryonic development is complicated by the facultative formation of a special distributive or resting stage - the hypopus. As in other mites, the immature stages resemble the adults in their feeding habits and general appearance; the hypopus, however, is an epimorphic stage differing in structure from the adult, which does not feed and serves only for the distribution of the species.



Figs. 28 - 40. Nymphal stages of the Tyroglyphidae

Fig.28 - Tyroglyphus farinae L, larva, dorsal surface. Fig.29 - T. farinae L, larva, ventral surface. Fig.30 - T. farinae L, larval 'bruststiele'. Fig.31 - T. farinae L, protonymph, ventral surface. Fig.32 - T. farinae L, telonymph, ventral surface. Fig.33 - Aleuroglyphus ovatus Troup., larva, dorsal surface. Fig.34 - A. ovatus Troup., larva, ventral surface. Fig.35 - A. ovatus Troup., larval 'bruststiele'. Fig.36 - Tyrophagus noxius A.Z., larva, ventral surface. Fig.37 - T. noxius A.Z., larva, dorsal surface. Fig.38 - A. ovatus Troup., 'bruststiele'. Fig.39 - Tyrolichus casei Ouds. larval 'bruststiele'. Fig.40 - Caloglyphus mandzhur sp.n., larval 'bruststiele'.

The Larva (figs. 28-30, 33-35, 44-45, 49-51) is characterised by the presence of three pairs of legs (legs IV are completely undeveloped and represented by a collection of subcuticle cells analogous with the imaginal discs of insects) and special temporary structure - chest rods (bruststiele) which are placed on the ventral surface of the propodosoma external to the setae of coxae I. These organs are homologous with the 'urstigmen' of the eonymphs of many representatives of the suborder Trombidiformes; they are very variable in shape, but usually have the appearance of mobile hollow tubes which are distally enlarged; their function is unknown. Characteristically, the development of the hysterosoma is feebler than in the succeeding stages (this is correlated with the absence of the hind pair of legs), and its volume only slightly exceeds that of the propodosoma, in those cases where a division between the two exists; it is also characterised by the absence of d_4 and l p and the great length of sa i, which function as pseudocerci, as is common in the first stages of development of the greater number of terrestrial Arthropoda. In addition to the above chaetotactic characters of the larva (which are discussed in greater detail in special parts of this work), it is necessary to mention the absence of genital, anal and adanal setae (only the first pair of postanals is developed), the absence of setae on the trochanters and the difference in position of some of the setae of the idiosoma, partly conditioned by stereometric moments, partly, however, having no visible relationship to the shape and later changes of the body. (For example, often a displacement of the posterior crista metopica setae takes place during development, which then occupy, in the larvae, a different position to the final one); besides this, some of the other pairs of setae are undeveloped in the larva, and remain undeveloped in the protonymph and in succeeding stages, including the adult, so that this character is not specific for the larva. The external genitalia are also not visible in the larva, and the sensilla delta and the middle dorsal seta of tarsus I is also absent.



Figs.41 - 45. Saproglyphus neglectus Berl.

Fig.41 - ♀, dorsal surface; lettering of setae as in fig.27. Fig.42 - ♀, ventral surface: ep - epigynium; a - anal setae; pa - postanal setae. Fig.43 - ♂, ventral surface. Fig.44 - Larva, dorsal surface. Fig.45 - Larva, ventral surface.

The first nymphal stage or protonymph (figs. 31, 52, 53) has already four pairs of well-developed legs, it lacks the typical larval organs and in structure resembles the sexually mature form. The characteristics of this developmental stage are the beginning of a genital opening with one pair of genital 'suckers', one pair of genital, three pairs of adanol setae (in those cases where they occur), the absence of setae on trochanters I to III and on the four basal segments of legs IV, and also the absence of the middle dorsal seta of tarsus I. On the dorsal surface, all the adult setae and their relative positions are somewhat different from the final one; also the position of some of the remaining setae (e.g. those at the posterior end of the crista) and the proportions of the extremity of the body may differ. In all other respects the protonymph has the same characters as the imago.

The telonymphal stage (figs. 32, 54-55) differs from the sexually mature adult only in its immature external genitalia, represented in both sexes by a small genital slit with two pairs of 'suckers' on each side, and by the absence of anal setae. It differs from the protonymph in having two pairs of genital 'suckers', a complete set of genital setae, in the presence of a ventral seta on trochanters I to III, and a middle dorsal seta on tarsus I, and in having the adult arrangement of setae on leg IV. Thus the morphological changes undergone by the Tyroglyphoidea in post-embryonic development are not great. In some cases, however, greater differences from the adult are shown by the nymphs of different ages. These differences may be due to two factors - (1) the fact that in the adult, additional structures are developed (2) in the nymph, special provision is made for other final structures; a most striking example of this is the nymph of Xenoryctes, which has scale-like, thick, bushy setae and a unique skin structure. These differences may also be the result of retardation in development of definite characteristics in the nymph (e.g. of the internal scapulars and humerals, and three of the anterior pairs of dorsal setae in Caloglyphus), or of the phenomenon of imaginal

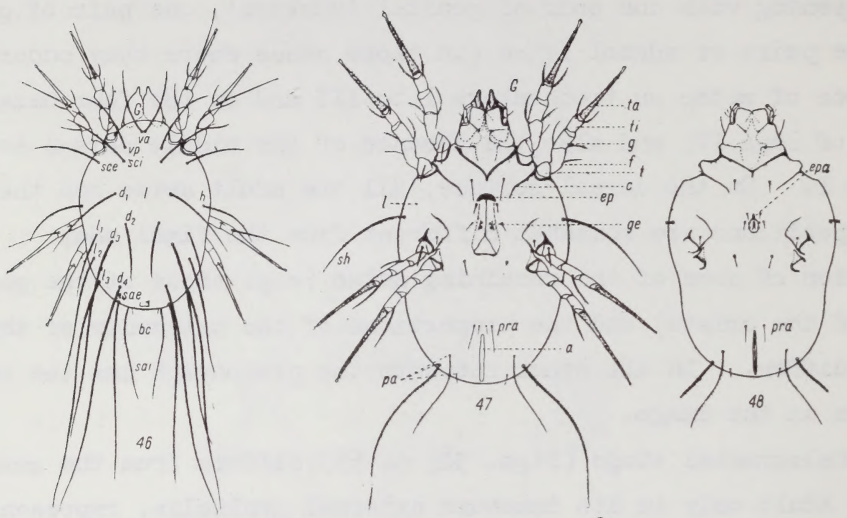
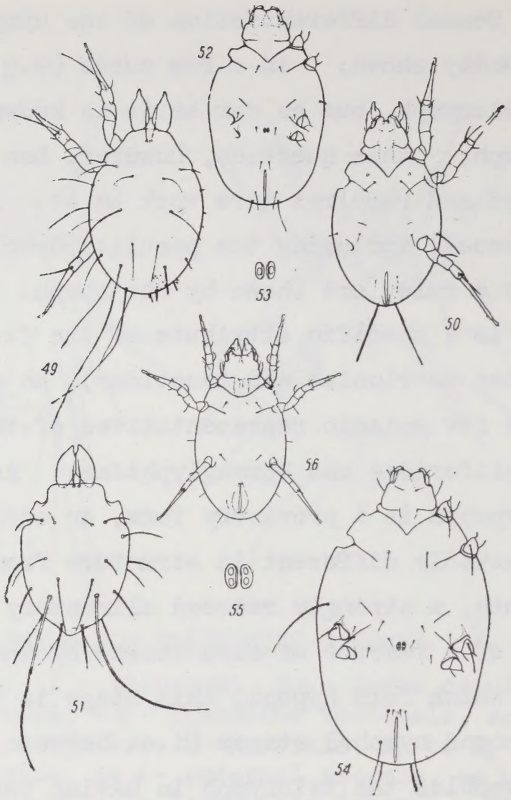


Fig.46. Glycyphagus destructor Schrank. ♀, dorsal surface.

G - gnathosoma; I - idiosoma; bc - bursa copulatrix; setae: va - anterior verticals, vp - posterior verticals, sci - internal scapulars, sce - external scapulars, h - humerals, d_1 to d_4 - dorsal setae, l_1 to l_3 - lateral setae, sae - external sacrals, sai - internal sacrals.
Fig.47, 48. Glycyphagus destructor Schrank. Fig.47 - ♀, ventral surface: G - gnathosoma; I - idiosoma; ep - epigynium; ge - genital opening; A - anal slit; setae: sh - subhumeral, pra - preanal, pa - postanal; legs: ta - tarsus, ti - tibia, g - genu, f - femur, t - trochanter, c - coxa. Fig.48 - ♂ . ventral surface, legs not drawn: epa - epiandrium, pra - preanal setae.

reduction (e.g. the reduction of the internal setae of the crista in the adult of Ctenoglyphus palmifer and the genital 'suckers' in Chortoglyphus, etc.). Sexual differentiation of the nymph in the Tyroglyphoidea is very feebly shown; in a few cases (e.g. Carpoglyphus) it is apparent in the telonymph, but as far as it is known, cannot be detected in the protonymph; this question, however, has not been sufficiently investigated and requires more work on it. In any case, secondary sexual differences, including the peculiar development of the heteromorphic ♂, are, as a rule, not shown by the nymph.

The hypopial stage is a specific attribute of the free-living Arcaridiae (Tyroglyphoidea detricolae and Anoetidae), an analogous stage is found only in a few epizoic representatives of the same group, i.e. in species of Falculiferidae and Dermoglyphidae. As has already been pointed out, the hypopus is a provisory form, an additional stage in the life cycle and markedly different in structure from the nymphs or adults, it has no mouth, a strongly reduced alimentary canal, and it lives at the expense of a reserve of food stored by the preceding nymph. In all species which form hypopi, this stage is intercalated between the first and second nymphal stages (i.e. between protonymph and telonymph). It resembles the telonymph in having two pairs of genital 'suckers', setae on trochanters I to III, as well as in the number of genital and anal setae. The hypopi are of two types - migratory and inert forms. The migratory forms assist in the dispersal of a species, and in those forms which have them, this biological function is carried out solely by them and they therefore play the part of a 'diaspore'. All hypopi have a passive form of migration; they attach themselves to different animals which serve as carriers, or more correctly, they use the method of phoresy (Lesne 1897, the epizoic method of Sernander). Consequently, they have an exceedingly rich collection of adhesive organs, serving to catch hold of the host, as well as to adhere to its surface; in their structure, also, they are adapted to the type of animal used as carrier. The latter can be either insects or other terrestrial arthopods, or mammals (Insectivores



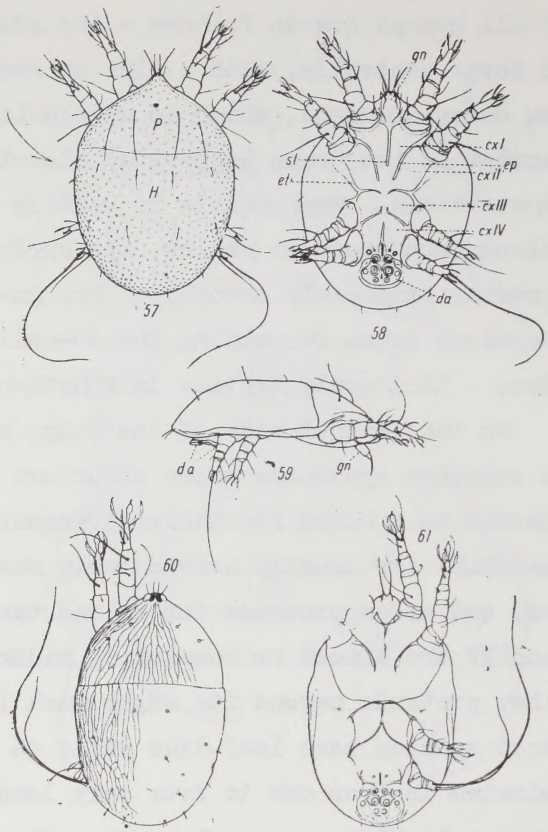
Figs.49 - 56. Nymphal stages of Glycyphagidae

Fig.49 - Glycyphagus destructor Schrank, larva, dorsal surface. Fig.50 - G. destructor, larva, ventral surface. Fig.51- G.ornatus Kram, larva, dorsal surface. Fig.52- G. destructor Schrank, protonymph, ventral surface. Fig.53- G. destructor, Schrank, protonymph, rudiment of genitalia. Fig.54- G. destructor Schrank, telonymph, ventral surface. Fig.55- G.destructor Schrank, telonymph, rudiment of genitalia. Fig.56- Chortoglyphus arcuatus Troup., larva.

and Rodents); accordingly hypopi may be divided into two groups - the entomophilic and terophilic forms.

The characters of all hypopi are as follows - the idiosoma is considerably flattened dorso-ventrally, with a flat or even concave ventral and more convex dorsal surface, which is shield-like in appearance and always (except in the genus Sennertia) clearly divided into propodosoma and hysterosoma. The cuticle is usually thickened, and often varies in colour from brown to yellow, its surface is variously sculptured (rarely completely smooth). The gnathosoma - much reduced - is an unpaired organ resembling the so-called tritosternum of the Gamasides; it is only tactile in function, and may be completely absent. On the ventral side of the body, behind the genital opening, is an adhesive apparatus whose structure varies in different hypopi and serves as a basis for their differentiation. Legs I and II (sometimes III) are usually considerably more developed than the posterior ones, and often protrude far beyond the edges of the body; legs III and IV are almost or completely hidden under the body; in any case, they protrude beyond its edges much less than the anterior ones. Most species have leaf-like setae on legs I to III, leg IV often terminates in from one to four very long macrosetae; in such cases ambulacra are lacking.

The entomophilic type of hypopus is the most usual form, and the one most frequently found in the Tyroglyphoidea; these hypopi (figs. 57-63) characteristically have an adhesive apparatus consisting of a special sucking disc on the posterior ventral part of the body bearing from three to four rounded fleshy suckers, and usually one to two pairs of sternal (coxal) suckers; this apparatus works on the pneumatic principle and enables the hypopus to fix itself to the smooth body of an insect and use it for migration. This function is also performed by a large number of other organs of fixation, but these, it seems, play a subordinate part, e.g. the sucking bristles which are dilated like saucers at their ends, leaf-shaped setae on the legs, etc. Some hypopi of this type which are carried by hymenopterous insects have



Figs.57 - 61. Migratory hypopi of Tyroglyphidae and Saproglyphidae

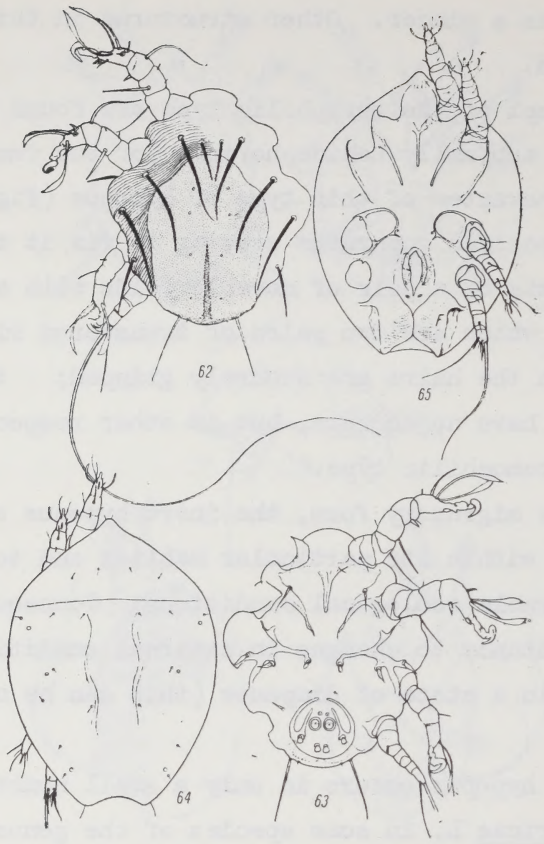
Fig.57 - Tyroglyphus farinae L, dorsal surface. Fig.58 - Ditto, ventral surface. Fig.59 - Ditto, lateral view. Fig.60 - Calvolia elliptica, sp.n., dorsal surface. Fig.61 - Ditto, ventral surface. Abbreviations: gn - gnathosoma; st - sternum; ep - epimeres II; et - epimerites II; cx - I-IV- coxal fields I-IV; da - sucking disc; P - propodosoma; H - hysterosoma.

a special device for fixing themselves to the insect hairs; this consists of a modified ambulacrum which has a spirally twisted claw, sometimes functioning as a pincer. Other structures in this type of hypopus are very varied.

The migratory hypopi of the terophilic type are found only in representatives of the subfamily Labidophorinae (of the family Glycyphagidae). The main character of this type of hypopus (figs. 64-65) is the presence of a specific apparatus serving to fix it to the hairs of mammals; it consists of a pair of movable folds with a ribbed internal surface beneath which are two pairs of transverse ribbed clasps, forming a vice by which the hairs are securely gripped; the hypopi of the terophilic type have no suckers, but in other respects are similar to those of the entomophilic type.

In contrast to the migratory form, the inert hypopus serves mainly to keep the species within its particular habitat and to ensure its survival under unfavourable ecological conditions. Consequently, these hypopi have great resistance to changes in external conditions, and can spend a long time in a state of diapause (this can be measured in months or even years).

The inert form of hypopus occurs in only a small number of species, e.g. in Tyroglyphus farinae L, in some species of the genus Chaetodactylus, and in the genus Glycyphagus. In Tyroglyphus farinae, this hypopus resembles the migratory form in its structure, and differs only in its weak mobility, somewhat reduced legs and sucking disc, structure of the cuticle, sense organs and gnathosoma; it shows a still greater similarity to hypopi of the Acotyledon type, which are intermediate between the migratory and immobile types, and which are also characterised by a reduction in the sucking disc. In the genera Chaetodactylus and Glycyphagus, an extensive reduction of locomotary, adhesive and sensory organs takes place. Such organs are almost absent in Glycyphagus domesticus Degeer, in which the immobile hypopus is represented by a spherical non-segmental body devoid of appendages and very similar to a Tardigrade cyst; this similarity is increased by the



Figs. 62 - 65. Migratory hypopi of Glycyphagidae

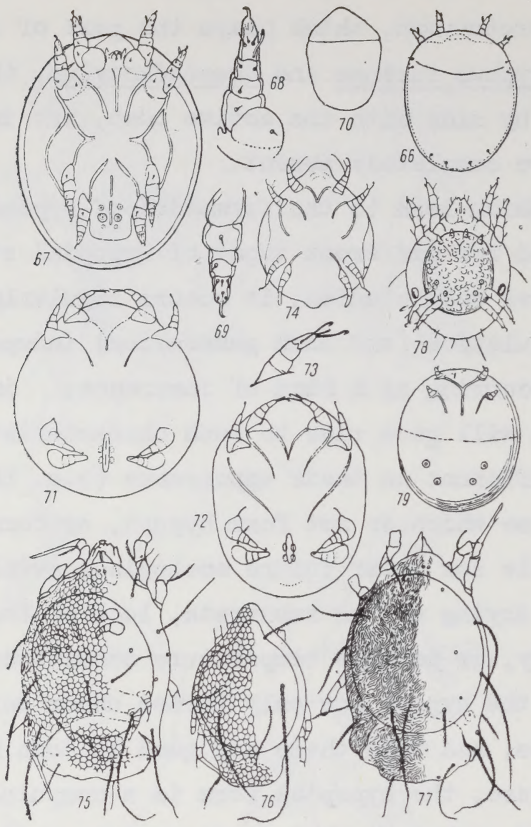
Fig. 62 - Sennertia horrida Vtz., entomophilic hypopus, dorsal surface. Fig. 63 - Ditto, ventral surface. Fig. 64 - Labidophorus sciurinus Koch, terophilic hypopus, dorsal surface. Fig. 65 - Ditto, ventral surface, F - clasping apparatus.

fact that hypopi of these genera remain imprisoned within the thickened exuvium of the protonymph, which plays the part of a protective covering. In Tyroglyphus farinae and Chaetodactylus, the inert hypopi are formed side by side with the active ones, but in Glycyphagus the migratory ones are completely absent.

The conditions which lead to the formation of hypopi differ in different species, and for different types of hypopial stages. In some species which have been studied, it occurs regularly in some individuals of each population (and each generation) independent of external conditions, occurring as a kind of insurance; in these cases the protonymphs which will give rise to such characteristic hypopi are often somewhat different in their appearance (e.g. they are wider in the body) from those which do not form hypopi, or form them under conditions unfavourable for their future ecological development; such conditions being the drying of the substrata, lack of food, or deterioration of its quality, or perhaps temperature conditions.

In other genera the hypopi are only formed under unfavourable environmental conditions, and when these are good it does not occur at all. In the third case, the hypopial form is a compulsory stage for all individuals, or else there is a definite rhythm in its occurrence (in a series of species inhabiting nests and strictly subordinate to the biological rhythm of the host). It is necessary to point out that in species which are capable of forming the two types of hypopi - migratory and inert - the reasons which condition their change into one or the other type may be completely different.

The characters of the immature stages of the Tyroglyphoidea are widely used in their classification, much attention in particular being paid to the motile hypopus and 40% of the species have been described from this form; whole groups - e.g. Chaetodactylinae and Saproglyphidae - are known only in this form. As a result, in addition to a classification based on the adult form, there is also one based on the hypopus. Until recently it was assumed that the characters of the hypopus were closely correlated with the systematic position of its



Figs. 66 - 79. Resting hypopi and nymphal skin of various Tyroglyphoidea

Fig. 66 - Tyroglyphus farinae L, resting hypopus, dorsal surface. Fig. 67 - Ditto, ventral surface. Fig. 68 - Ditto, leg I, ventral surface. Fig. 69 - Ditto, leg IV, ventral surface (after Schulze). Fig. 70 - Glycyphagus destructor Schrank, resting hypopus, dorsal surface. Fig. 71 - Ditto, ventral surface. (Diagram of a specimen mounted in Berlese-Faure medium). Fig. 72 - Ditto, diagram of a living specimen. Fig. 73 - Ditto, leg I, dorsal surface. Fig. 74 - G. michaeli Ouds, resting hypopus, ventral surface (after Michael). Fig. 75 - G. destructor Schrank, nymphal skin. Fig. 76 - Ditto of G. michaeli Ouds. (after Michael). Fig. 77 - Ditto of G. domesticus Deg. Fig. 78 - Ditto of Chaetodactylus osmiae Duf. Fig. 79 - Ch. osmiae, resting hypopus, ventral surface (after Trouessart).

adult form; in other words, that the classification based on the hypopus coincides with that based on the imago; on the basis of this assumption, the adults of some genera, e.g. Caloglyphus and Cosmoglyphys are distinguished only by the characters of their hypopi. Whilst preparing this monograph, it became clear from a more detailed study of its representatives that such is not the case. It was established that, if in some groups there is actually a parallelism in both systems, in others the grouping of the hypopi does not correspond with that of the imagos; conversely, clearly defined imaginal groups do not correspond with those of the hypopi (in all the subfamilies and tribes of the family Tyroglyphidae, the genus Acotyledon, etc.). One therefore sees here the same relationship as exists between the larval and imaginal stages of the Holometabola, and therefore the hypopial stages should only be of temporary significance. In contrast to this, the characters of the nymphal stages are always related to those of the adults, and give valuable indications of the systematic relationship between the adults.

Classification and Position of the Group Within the Acari

Up to the year 1920 - a time marked by the complete reorganisation of the suborder Sarcoptiformes, the free-living Tyroglyphoidea, together with the Anoetidae, were placed by some authors in one family - the Tyroglyphidae - or in one subfamily Tyroglyphinae of the family Sarcoptidae. This family (really a subfamily) differed from neighbouring groups in being almost exclusively free-living, in contrast to the parasitic and epizoic habits of related forms. Morphological characters assumed a subordinate position in this diagnosis and were mainly negative in character (e.g. absence of skin wrinkling, non-stalked praetarsi). Owing to this, such unrelated groups as the Tyroglyphidae and Anoetidae were united together and the obvious relationship between the first of these groups and many parasitic and epizoic forms (which were placed in

the subfamilies Analgesinae and Sarcoptinae etc.) was disregarded.

In Oudemans' classification (worked out by him in 1923-7 and later only slightly altered by Vitzthum and Sig. Thor), which is accepted by contemporary authors, the members of the group under discussion were not united with each other, but were placed in the cohort Diacotricha. This was composed of 15 independent families, and included also the Anoetidae, Canestriniidae, and a whole series of epizoic and parasitic groups - Acaridae (= Sarcoptidae), Listrophoridae, Eusthiidae, Analgesidae, Falculiferidae, Syringobiidae, and Dermoglyphidae. This first cohort is in contrast to the second cohort - Anacotricha - which is composed of the remaining epizoic and parasitic species living on Vertebrates, i.e. the Acaridiae (Avenzoaridae, Proctophyllodidae, Psoralgidae, Epidermoptidae, Psoroptidae, Heterosporidae, Laminisoptidae) and connected with insects - Linobiidae, Hemisarcoptidae. These two cohorts form a supercohort of the Acaridiae and, together with the Oribatei, comprise the suborder Sarcoptiformes.

Only one character - emphasised by their names - i.e. the presence or absence of internal vertical setae, separates the two cohorts (superfamilies), Diacotricha and Anacotricha, from one another. The great systematic significance which is given to this character, on a more balanced valuation, turns out to be arbitrary and without any foundation; actually it has no relationship with any big complex of characters which might indicate the systematic proximity of species bearing them. Alternatively, this character is not universally significant, since amongst the Diacotricha there is a series of forms, and even complete groups, where the vertical internal setae are greatly reduced (Xenocastor) or completely absent (Monieziella and almost all Listrophoridae); furthermore, the absence or presence of these setae in different groups depends on geographical or individual variation. It follows therefore that division of the Acaridiae into two cohorts is quite artificial, and also that all members of this group comprise one large, undivided, and diverse assemblage.

Therefore, according to this classification the group Tyroglyphoidea has ceased to exist as such; it has been subdivided into a number of independent families, and the position of its representatives in the group Acaridiae remains obscure.

This position arose as a natural result of the conventional approach adopted by Oudemans and his successors in the building up of a system of classification of the Acari. Single characters, chosen at random, were used as its basis and these were regarded as major characters without analysis, without evaluation of the nature of their relationship, and without considering the sum total of these characters. The rich assortment of characters which should have been utilised for a correct understanding of relationship remained untouched by systematic investigation; also, the principal characters selected were frequently changed. This led to a constant reconstruction of the system of classification, and transferance of individual forms from one group to another; in addition, the scale of systematic differences was not assessed, and this led to the obvious exaggeration of the taxonomic level of separate groups and resulted in excessive subdivision. All these drawbacks in the contemporary classification of the Acari places insurmountable obstacles in the path of a correct understanding of the factual relationships existing between the groups of mites, and in particular for the final position in it of the group of Tyroglyphoidea detricolae. Being unable to study the vast series of Acaridiae, I have been obliged to restrict myself to the improvement of the systematics of the group here under discussion, and to ignore its relationship with neighbouring groups. This work has led (i) to the assembling of one group - the Tyroglyphoidea detricolae - whose general characters are given on Page 1, (ii) to establishing that the multitude of free-living Acaridiae, which Oudemans divided into 21 families, forms naturally four groups of family status, to which are assigned the following names - Saproglyphidae, Tyroglyphidae, Glycyphagidae, and Anoetidae. Of these the first three are closely related to each other and to the series of epizoic and parasitic forms;

the fourth is isolated in this system, and must be placed in a separate superfamily - the Anoetoidea. In the system of classification used here, the family Tyroglyphidae corresponds to five of Oudemans' families - Tyroglyphidae Ouds: 1932, Caloglyphidae Ouds: 1932, Tyrophagidae Ouds: 1924, Rhizoglyphidae Ouds: 1923, Forcelliniidae Ouds: 1924; the family Saproglyphidae, as I understand it, equals the families Saproglyphidae Ouds: 1923, Winterschmidtiidae Ouds: 1923, Ensliniellidae Vitzthum 1925 (not 1931), Czenspinskiidae Ouds: 1927, Nanacaridae Ouds: 1924, Pontoppidaniidae Ouds: 1924. To the family Glycyphagidae I assign the representatives of Oudemans' families - Glycyphagidae, Chortoglyphidae, Carpoglyphidae, Lentungulidae, and part of Ensliniellidae of Vitzthum 1931 (the genera Horstia and Tortonia). I am convinced that a corresponding study of other Acaridiae, as well as of other groups of mites, if based on the principles of natural biological systems, would result in a similar sharp reduction in the number of families now accepted.

Geographical Habitats

The group Tyroglyphoidea detricolae is not sufficiently wellknown for one to form any opinion on the distribution of its representatives in the Zoogeographical regions. The number of species described in these regions is only an indication of the amount of investigation carried out in one particular region, it throws little light on the number of species that inhabit it, and therefore is of no assistance. Also, there is a lack of data which might establish that a certain group is confined to a definite zoogeographical region. In most cases, regions inhabited by separate varieties also remain obscure and are only enlightened by isolated cases which have undergone a more intense investigation. One can only say at present that the group under investigation is cosmopolitan in distribution and is richly represented in temperate and tropical zones of both hemispheres, some species extending

into the arctic and subarctic zones; 180 of the 250 described species are known from the palearctic.

The existing data concerning the distribution of the synantropic species of the Tyroglyphoidea is also too incomplete for a final assessment of its character. They only allow one to conclude that the majority of species (except Tyroglyphus farinae L. and Rhizoglyphus echinopus F. and R.) are not cosmopolitan, their distribution being confined to definite regions. This becomes obvious when one compares the European species of granary mites with those of the U.S.A. (Species of Glycyphagus, Aleuroglyphus, Thyreophagus, Histiogaster, Gohieria and others are absent from the U.S.A, whilst other species [Tyrophagus americanus Banks, T. armipes Banks] are not found in Europe.) Even separate European countries show marked differences in this respect. Thus Caloglyphus rodionovi A.Z. is widely distributed on the Continent, but it seems that it is not found in England. Tyrophagus longior Gervais (= infestans Berlese) is said to exist in Western Europe, and in the U.S.S.R. is replaced by other species. The distribution of individual species of granary mites with the U.S.S.R. is also not uniform; some are found in more northerly regions (Glycyphagus michaeli Ouds.), others in the south (Tyrophagus noxius A.Z. or T. perniciosus A.Z.). Still more sharply defined is the uniformity of distribution of these species in the field, so that each region, so far studied in this respect, has its own collection of species which is found in the field under local conditions. In the steppes in Bashkiria (Sterlitamak region) were found Tyroglyphus farinae L., Tyrophagus humerosus tesquorum A.Z., Caloglyphus rodionovi A.Z., Acotyledon sokolovi A.Z. and three species of Glycyphagus - G. destructor Schrank, G. michaeli Ouds., G. domesticus Degeer. In the steppes near the Caucasus (Vorashilof, Blagodarnensk region) have been found Tyroglyphus farinae L., Tyrophagus perniciosus A.Z., T. humerosus tesquorum A.Z., Calyglyphus rodionovi A.Z., Acotyledon batsylevi A.Z., Glycyphagus destructor Schrank and G. domesticus Degeer. In the Ivanovsk region (suburbs of Kirjach) the field fauna of the corn mites consists only of

Tyroglyphus farinae L, Acotyledon sokolovi A.Z., Glycyphagus destructor Schrank, G. michaeli Ouds., G. cadaverum Schrank, and Chortoglyphus arcuatus Troup. For a more detailed account of the synantropic and field distribution of these species, sufficient data does not exist.

Ecology

The ecological features common to the Tyroglyphoidea detricolae are as follows:

a) A saprophytic mode of living in all stages of their development;

b) Hygrophilism;

c) The lack of means for active dispersal and a wide use of various passive means of dispersal;

d) The capacity for forming special migratory hypopial stages.

General conditions of living. The greatest number of free-living Tyroglyphoidea inhabit dead, preferably decaying, organic materials (mainly of plant origin), which serve at the same time as food or as a substrate for micro-organisms which sometimes form their food. They occupy all possible types of habitat created by the accumulation of such substrates, either naturally or in human households; their ecological range is also increased by their use of materials derived from live plants - e.g. onions, root vegetables, and other subterranean parts of the Angiosperms (in rare cases even the aerial parts are also attacked), seeds, mushrooms, and seaweeds. The general conditions necessary for their life on these substrates are: a sufficiently high humidity, low O_2 content, and protection from the direct rays of the sun. The humidity of the substrate is of great importance as a necessary condition of life of the Tyroglyphoidea, not only as a source of water supply during feeding, but in connection with the cuticular method of respiration which

is characteristic of all representatives of this group. On account of this method of respiration, the cuticle is delicate and the percentage of free water in the body high (according to H. Schulze, the total water content of the body of Caloglyphus rodionovi A.Z. reaches 83%). Thus their existence depends on a sufficiently high percentage of water vapour in the air. For the majority of species so far studied, the minimum relative humidity at which existence is possible is above 60%, the optimum is 80-90%, sometimes 100%. For Tyroglyphus farinae L., for example, the minimum relative humidity is 60%, the optimum 75-80%; for Tyrophagus noxius A.Z. 70% and 90%; for Aleuroglyphus ovatus Troup. the minimum is above 75% and the optimum about 90%; the optimum for Rhizoglyphus and Caloglyphus approaches 100% (the minimum for C. rodionovi A.Z. is about 90%). Owing to the close relationship between the humidity of the air and that of the substrate, there exist definite optimum or minimum moisture contents of substrates as well (the moisture content varies with temperature and type of substrate and is determined by the specific capacity of the substrate for absorbing moisture).

NOTE: The humidity of most substrates inhabited by Tyroglyphoidea is, owing to hygroscopicity, closely related to that of the surrounding air, and also is in constant reciprocal equilibrium, so that for each value of atmospheric humidity a corresponding definite percentage (specific for each type of substrate) of water is absorbed from the atmosphere, until an equilibrium is set up; conversely, excess water contained in the substrate may be passed on to adjacent layers of air. This dynamic equilibrium between humidity of the atmosphere and that of the substrate leads to their mutual regulation; the specific power of absorption or loss of water by the substrate, in association with the temperature of the surroundings, leads to differences in the figures of the here-established relationship. Thus Tyroglyphus farinae L. can develop in flour only when its humidity is not lower than 12.5%, in wheat not lower than 13.4%; the optimum humidity for these commodities is 15-16% and 18-19%; the minimum for Caloglyphus rodionovi A.Z. for the substrate is

22%, etc.

A whole series of factors contributes towards providing a suitable habitat for the Tyroglyphoidea; of fundamental importance is the maintenance of humidity by protection from wind and the direct rays of the sun; the structure of the substrate also must be such that it reduces the evaporating powers of the air in the surrounding atmosphere.

With regard to temperature, this group of mites is, as a whole, less affected by this than by humidity, and different species vary in this respect, e.g. the zero point for the development of Tyroglyphus farinae L. lies below 8°C., it equals approximately 9° for Tyrophagus noxius A.Z., 16° for Caloglyphus rodionovi A.Z., 20-21° for Aleuroglyphus ovatus Troup. The optimum temperature for development is from 20-22° for Tyroglyphus farinae L., 25° for Tyrophagus noxius A.Z., 30-31° for Caloglyphus rodionovi A.Z., 35° for Aleuroglyphus ovatus Troup. If one takes into account that this data relates to the representatives of only one habitat - such as a barn - i.e. to mites which are ecologically related to one another, one can presume that the range of temperature for development varies more for other groups of Tyroglyphoidea.

The feeding habits of the Tyroglyphoidea are very varied. Most species are characterised by a high intake of food and they can utilise a great variety of vegetable and animal substrates. In other cases, the choice of substrate is limited and some species are even restricted to one type only. One should note, however, that our knowledge on this point is inadequate; on the one hand, it is difficult to separate the feeding properties of the substrate from other environmental factors (which determine the possibility of mites inhabiting these substrates); on the other hand, there is the possibility that the mites do not feed on the substrate, but on the microflora inhabiting it. In a few cases it has been possible to show a connection between the substrate and its chemical composition, e.g. the dependence on the presence of certain acids. Thus Carpoglyphus lactis L. lives

on substances containing lactic, succinic, and acetic acids, and species of Histiogaster require the presence of acetic acid. It is also possible that the limitation in variety of feeding substrate is due to the necessity for it being in a suitable structural state, e.g. a powdery condition for Thyreophagus and Gohieria.

Types of habitation. These can be classified into the following 16 types, which differ among themselves according to the species of Tyroglyphoidea which inhabit them:

1. Stocks of agricultural products in barns, warehouses, and inhabited buildings - a complex habitat of this kind can be considered under three sub-divisions, each associated with an assortment of species different from the other two:

   (a) Stacks of grain and the seeds of different cultivated plants, as well as their products (flour, chaff, etc.), serve as a habitat for many species of Tyroglyphoidea. The most characteristic are Tyroglyphus farinae L., Tyrophagus noxius A.Z., Tyrophagus perniciosus A.Z., T. americanus Banks, Tyrolichus casei Ouds., T. lini Ouds., Aleuroglyphus ovatus Troup., Caloglyphus rodionovi A.Z., Thyreophagus entomophagus Lab., Chortoglyphus arcuatus Troup., all species of the genus Blomia and Glycyphagus, Cometacarus smirnovi A.Z., Gohieria fusca Ouds. and "Glycyphagus" robustus Banks. Most of these species are omnivorous in habit, but a few are restricted to certain substrates (e.g. Thyreophagus, Gohieria). The greatest number of the above-mentioned species are widely distributed in the field, but some are more restricted (Tyrophagus noxius A.Z., Tyrolichus lini Ouds., species of Blomia, Thyreophagus, Gohieria, etc.); the latter are characterised by their adaptation to a higher temperature and weak dispersal methods (absence of hypopus and weak mobility etc.). In some places, the normal species found in this type of habitat have species associated with them which are normally found in different natural habitats, e.g. Tyrophagus humerosus Ouds.,

T. tenuiclavus A.Z., many species of Acotyledon, some Calvolia sp. etc. Stores of dried fruit, vegetables, medicinal grasses and other dried plants, as well as dried substances of animal origin, are inhabited by representatives of the same barn complex. The commonest species are those of the genus Glycyphagus, Carpoglyphus lactis L. - usually connected with fruit products, and also found in sour jam, stale confectionary, wine and decomposing milk. The fauna of cheese is somewhat different, some of the barn species belong to it, as well as Tyroglyphus farinae L., Tyrolichus casei Ouds. and another series of species more strictly adapted to this substrate - Tyrophagus longior Gerv. (= infestans Berlese), Acotyledon sironiformis F. and R., A. terminalis Banks, Calvolia zacheri Ouds.

(b) Vegetable and flower bulbs, roots and tubers have their own particular fauna, of which the most important members are Rhizoglyphus echinopus F. and R., Caloglyphus sphaerogaster A.Z., C. mandzhur A.Z., Tyrophagus tenuiclavus A.Z.; on these substrates are sometimes found the most omnivorous of all the barn species, such as Tyroglyphus farinae L., Tyrophagus noxius A.Z., Caloglyphus rodionovi A.Z.

(c) The hay in lofts and stables has its own particular population of Tyroglyphoidea, composed of the common barn species (Tyroglyphus farinae L., Tyrophagus Sp., Chortoglyphus, most species of Glycyphagus) as well as members of the subfamily Ctenoglyphinae, which are more restricted ecologically; here also are included species which are really typical of the next type of habitat.

2. The accumulation of plant remains in fields is widely used by the Tyroglyphoidea as a habitat. Of particular importance are the great piles of stores formed as a result of agriculture, e.g. haystacks, piles of straw, heaps of corn sweepings, etc., and their importance is directly proportional to the time that they are left

in the field. Amongst the Tyroglyphoidea which inhabit these places, the dominant part is played by the corn mites - Tyroglyphus farinae L., Tyrophagus sp., Glycyphagus sp., but here also are found many non-granary species of Acotyledon (A. redikorzevi A.Z., A. batsylevi A.Z., A.sokolovi A.Z., etc.), Tyrophagus humerosus Ouds., T. tenuiclavus A.Z., some Calvolia and Forcellinia. A similar, but less varied fauna inhabits smaller accumulations of plant remains (e.g. vegetative remains of grassy plants), but only where a suitable humidity is maintained over a period of time.

3. The soil of fields - Tyroglyphoidea (e.g. Tyroglyphus farinae L., Tyrophagus perniciosus A.Z., Glycyphagus sp.) are often found in the surface layers of cultivated fields, where they live on vegetable debris, such as non-germinating seeds, other small parts of plants which have become buried in the ground. Other species (e.g. Tyrophagus humerosus Ouds., Rhizoglyphus) live at the expense of the subterranean parts of living plants. No data is available concerning the soil fauna.

4. Dead leaf covering - certain of the granary species (e.g. Tyroglyphus farinae L., Glycyphagus destructor Schrank, G. michaeli) inhabit this layer, but the bulk of the population is composed of the following species - Acotyledon tshernyshevi A.Z., Forcellinia diamesa A.Z., Caloglyphus tshernyshevi A.Z., Schwiebia pachyderma A.Z., also Sancassania chelona Ouds., Acotyledon eurynympha Ouds., Troupeauia mycobora Ouds., Schwiebia talpa Ouds., Calvolia hagensis Ouds. which have not been found in our country. In addition, Tyroglyphus tyrophagoides A.Z., Tyrophagus humerosus silvester A.Z., Acotyledon sokolovi A.Z. have also been found, but they are not adapted to this habitat, also Rhizoglyphus echinopus, which is a cosmopolitan form.

5. Rotting wood - in old stumps, wood frass, sawdust, insect galleries and under bark lives a very varied and rich fauna of Tyroglyphoidea - Caloglyphus tshernyshevi A.Z., Schwiebia rossica A.Z., S. ipidis Vitz.,

S. tshernyshevi A.Z., Histiogaster carpio Kramer, species of Troupeauia rodionovia, and a large number of representatives of the family Saproglyphidae (Saproglyphus, Winterschmidtia, Calvolia sp.). Species of the last named genus are biologically connected with bark and wood-eating insects, which serve as transporters for their hypopi; to this group also belong species which live in the nests of Hymenoptera in wood (they will be dealt with in more detail later).

6. In the sap exudate of trees, and in the bark saturated with it, are found species of the genus Hericia, who are semi-aquatic.

7. Roots and other subterranean parts of plants (in fields) serve as a habitat for the voracious Rhizoglyphus echinopus F. and R. and some Caloglyphus sp. (C. heteromorphus Felt., C. phylloxerae Riley, Tyrophagus sp., Monieziella (?M. minuta Dem.).

8. The green parts of living plants are only exceptionally used by the Tyroglyphoidea. Here are found Tyrophagus humerosus Ouds. which mainly lives on germinating seeds (occasionally harming them); on the leaves of marrows and other Cucurbitaceae infested with web-spinning mites are found species of Calvolia (C. hebeclinii Sich. and the more cosmopolitan C. heterocoma Mich.).

9. Fungi - the pileus of mushrooms and toadstools have a fairly specific fauna, consisting of Caloglyphus mycophagus Meg., C. berlesii Mich., Histiogaster silenus A.Z. Acotyledon alberti A.Z., Forcellinia fungivora Ouds. and F.(?) lintneri Osb., and Saproglyphus neglectus Berl. A considerable number live on the lower fungi, e.g. on different moulds living on the same substrate.

10. Collections of seaweeds - on the stones and breakwaters in the intertidal region. These are inhabited by littoral genera - Hyadesia and Pontoppidania which are the only representatives of the group (if one does not include the uncertain Acaridina balaenarum van Beneden, which was found on whales).

11. Mosses and lichens - amongst mosses and under stones have been found isolated species of the Tyroglyphoidea - (Tyrophagus dimidiatus Herm., Caloglyphus, Robinisca, Monieziella magna Berl., "Rhizoglyphus" occurens Berl., "Rhizoglyphus" algidus Berl., and Calvolia heterocoma Mich.), but here they are considerably less represented than the Oribatei and the habitat has not been greatly studied.

12. The nests of solitary and social bees and wasps are inhabited by many species of Tyroglyphoidea, which play the part of commensals and in most cases are strictly associated with one genus or species of host; a particularly large number of species is connected with bees and wasps which build their nests in trees. Examples which have been studied can be tabulated as follows:

Hosts	Commensals
Family Apidae	
Prosopis conformis Först	Vidia undulata Ouds.
Xylocopa violacea L.	Sennertia cerambycina Scop.
X. valga F.	Sennertia cerambycina Scop. S. gargantua A.Z.
X. punctilabris Mor.	S. gargantua A.Z.
X. varentzovi Mor.	S. cerambycina Scop.
X. przewalskii Mor.	S. cerambycina Scop.
X. turanica Mor.	S. cerambycina Scop.
X. nitidiventris Sm.	S. cerambycina Scop.
X. kalinovskii Rad. (circumvolans)	S. alfkeni Ouds., Horstia ornata Ouds.
X. dissimilis Lep.	S. horrida Vitz., S. dissimilis A.Z., S. oudemansi A.Z., Horstia helenae Ouds.
X. combinata Rits.	S. bifilis Can., Horstia trifilis Can.
X. ordinaris Sm.	Horstia pulcherrima Vitz.

Hosts	Commensals
Koptorthosoma nigrita F.	Ceroglyphus monstrosus Vitz., "Glycyphagus" geniculatus Vitz., Sennertia morstatti Vitz., S. perturbans Vitz., S.simplex Träg., Horstia glabra Vitz.
K. caffra L.	Sennertia caffra Vitz.
Platynopoda tenuiscapa Westw.	S. greeni Ouds., S. koptorthosomae Ouds., S. hipposivedos Ouds.
Chelostoma florisomnis L.	Chaetodactylus birulae A.Z.
Osmia rufa L.	Chaetodactylus osmiae Duf.
O. Kohli Ducke.	Chaetodactylus osmiae Duf.
O. dimidiata Mor.	Chaetodactylus osmiae Duf.
O. tricornis F.	Chaetodactylus osmiae Duf., Ch. claviger Ouds.
O. panzeri Mor.	C. réammuri Ouds.
O. leucogastra Mor.	C. réammuri Ouds.
O. emarginata Lep.	C. réammuri Ouds.
O. leeana Kirby	Tortonia intermedia Ouds.
O. solskyi Mor.	Tortonia intermedia Ouds.
O. nigriventris Zett	Tortonia intermedia Ouds.
Lithurgus dentipes Sm.	Chaetodactylus ludwigi Trt.
Megachile doderleini Fr.	Cerophagopsis skorikovi A.Z.
M. bombycina Rad.	Chaetodactylus dementjevi A.Z., Vidia lineata Ouds.
M. ligniseca Kl.	Vidia lineata Ouds., Chaetodactylus dementjevi A.Z.
Megachile sp. sp. div.	Vidia lineata Ouds.
Anthidium 7-dentatum Latr.	Tortonia dogaressa A.Z.
A. stricticum F.	Chaetodactylus anthidii Ouds., Tortonia smitsvanburgsti Ouds.
A. laticeps Mor.	Neohorstia mamillata A.Z.
A. pubescens Mor.	Neohorstia mamillata A.Z.
A. manicatum L.	Sennertionyx manicati Giard
A. oblongatum Latr.	Sennertionyx manicati Giard.

Hosts	Commensals
A. cingulatum Latr.	Sennertionyx manicati Giard.
A. florentinum F.	Sennertionyx manicati Giard.
A. diadema Latr.	Sennertionyx manicati Giard.
Bombus sp. sp. div.	Kuzinia laevis Duj., Cerophagus granulatus Duj.
Family Sphegidae	
Crabro fossorius L.	Vidia gussakovskii A.Z., Lackerbaüria cribratissima A.Z.
C. impressus Sim.	Vidia gussakovskii A.Z., V. popovi A.Z.
C. vagus L.	Vidia gussakovskii A.Z.
C. solenius L.	Vidia gussakovskii A.Z.
C. clypeatus L.	Vidia popovi A.Z.
C. alatius Pnz.	Vidia popovi A.Z.
C. wollmanni Kohl.	Vidia popovi A.Z.
Family Vespidae	
Odynerus (Lionotus) floricola Sauss.	Ensliniella parasitica Vitz.
O. (L.) rossii Lep.	Ensliniella kostylevi A.Z.
Pollistes gallicus L.	Carpoglyphus vagabundus Berl.

13. Ant heaps - among the palearctic Tyroglyphoidea, only the following are myrmecophilous - Forcellinia wasmanni Mon., F. gigantonympha Vitz., Froriepia vimarensis Vitz., and probably also Calvolia bulgarica Štorkán and Acotyledon krameri Berl.; to the exotic forms belong Acotyledon oudemansi A.Z., "Tyroglyphus" javensis Ouds., "T." australasiae Ouds., "T." vandergooti Ouds., and the original Myrmoglyphus (= part of Acotyledon), M. triscissus Vitz., and M. bipilis Vitz.

14. Termite nests - up to the present only one species - Acotyledon feytaudi Ouds. - is known, living in the nests of Reticulitermes lucifugus Rossi.

15. Rodent and Insectivore nests. The lining of dead plants and the stones in the burrows of small mammals have a rich fauna of Tyroglyphoidea. In the mole's nest the rich fauna includes Fuscarus laminipes Mich., Talpacarus platygaster Mich., Oryctoxenus dispar Mich., Xenoryctes krameri Mich., X. heptneri A.Z., Labidophorus talpae Kramer, Myoacarus hypudaei C.L. Koch (from hypopi only) and also Tyroglyphus farinae L., Aleuroglyphus ovatus Troup., Robinisca mycolicha Ouds., Viedebanntia schmitzi Ouds., and Glycyphagus ornatus Kramer. Many of these species are also found in the nests of shrew mice with Labidophorus soricis Ouds.; other species of the genus Labidophorus Kramer are adapted to the nests of musk rats - (L. desmanae A.Z.) and the nests of the Far East Mole (L. mogerae A.Z.). In the field mice nests live species of the genus Mycarus, Labidophorus soricis Ouds., Tyroglyphus farinae L., Forcellinia fungivora Ouds., some Tyrophagus, Aleuroglyphus ovatus Troup., and Glycyphagus ornatus Kram.; only T. farinae has been found up to now in the nests of the Siberian Marmot. Squirrels' nests serve as a habitat for Labidophorus sciurinus C.L. Koch and Calvolia heterocoma Mich. The consistent discovery of barn species, including T. farinae L., in the lining and stones of rodent burrows seems to me to support Z.S. Rodinov's theory of the nidicolous origin (more correctly, the basic nucleus) of the barn group of Tyroglyphoidea.

16. Caves - only three species have been found here - Tyroglyphus (Caloglyphus?) spelaeus Berl., Steroglyphus hemisphaericus Berl., and Schwiebia cavernicola Vitz., the latter was found in a shallow puddle.

Means of dispersal. The majority of the Tyroglyphoidea are restricted in activity, often clumsy and slow in movement, almost incapable of covering large distances. Their speed of movement depends on the type of substrate and varies in different species from 4 to 5 mm. (5.2

in Caloglyphus rodionovi A.Z., 6.2 to 7.5 in Chortoglyphus) to 30 to 40 mm. per minute (Tyrophagus noxius A.Z. - Suzulina 1936); species of the genus Glycyphagus are the fastest runners of the whole group, attaining a speed of 60 to 65 mm. (G. destructor Schrank) or even 150 mm. per minute (G. michaeli). The distance covered is seldom in a straight line, so that the actual dispersal distance (calculated as a straight line) is less than that shown by the figures above (2.9 to 4.4 mm. for Chortoglyphus, 23.7 to 26 mm. for T. noxius, 41.7 to 59 mm. for G. michaeli etc.). The possibility of an active dispersal is still further lessened and restricted by their narrow ecological limits (mainly in relation to humidity), which permit them to move only within the correct micro-climate; this is seldom constant over great distances. However, dispersal is exceptionally vital to this group (namely, in connection with the stenovalency of the immature and adult stages) and movement is of prime importance, as their habitats are scattered or separated by (for them) insurpassable distances; the fluctuating humidity of many habitats also necessitates a constant migration of mite population from one place to another, this depending on the variations of the micro-climate in the different regions of the biotope (e.g. in the different layers of plant debris). This anomaly between the weak capacity of the Tyroglyphoidea for active dispersal and its biological necessity is solved by the fact that they make use of various passive means of dispersal.

Dispersal by means of air currents (anemohoria) is important in this connection. Biologically connected with this is the existence, in many of the Tyroglyphoidea, of special structures which tend to increase the area of parts of the body. They consist of large (sometimes enormous) setae on the idiosoma, sometimes feather, leaf or fan-shaped and capable of acting as "sails". This means of dispersal is evidently made use of by all the developmental stages of the Tyroglyphoidea, including the larva, (the majority of which have strongly developed posterior setae which function in the same way as the sail-like pseudocerci found universally in the first larval stages of terrestrial insects),

and also the migratory hypopi; in the latter, the long macrosetae of the fourth pair of legs which are present in most species, can be regarded as adaptations for wind transport. The possibility of dispersal by wind of the resting hypopi of the genus Glycyphagus, which remain enclosed in a nymphal skin, is also quite real (Mégnin 1880).

More frequently met with among the Tyroglyphoidea is dispersal with the assistance of other animals (Zoohoria); most important is the epizoic method or phoresy in which the mites become attached to the surface of the transporting animals and, in the course of the subsequent wanderings of this animal, reach a suitable environment for further development and breeding. Phoresy is mainly brought about by distributory hypopi - a stage in the life history especially adapted to carrying out this function. This stage is richly provided with various organs of fixation, usually built according to the so-called "trutztypus", it also has great resistance, in comparison with other developmental stages, to adverse conditions, (which ensures its survival on its travels when subjected to unavoidable changes in environment). As hosts, hypopi use either small mammals (Rodents or Insectivores are used by those species having hypopi of the Labidophorinae type) or insects and other terrestrial Arthropoda (used by all other groups of Tyroglyphoidea). At the same time, as transporter, some mites utilise one particular species (or group of closely related species), with whom they are in close biological relationship (commensals), whereas others attach themselves to any object with which they come in contact. A clear idea of the relationship existing here with be obtained from the following table, in which are collected the examples of hypopi which distribute themselves by phoresy.

Note: In this list are given facts established by the author, as well as others mentioned earlier in the literature.

Species of Mite	Transporter
Family Tyroglyphidae	
Troglyphus farinae L.	Hardback beetle: Tenebrio molitor L. Various small Staphylinidae and other saprophytic beetles. Osmoderma eremita Scop. Bumble bee: Bombus terrestris L. Fleas: Pulex irritans L., Hystrichopsylla talpae Curt., Ctenopsylla segnis Schönnch., Ctenophthalmus breviatus W. and J., C. pollex W. and J., Ceratophyllus tesquorum W. Siberian marmot: Citellus sp. Field mouse: Microtus sp.
Kuzinia laevis Duj.	Bumble bees: (all species of the genus Bombus s.l.). Bees: Xylocopa pavlovskyi Popov., Osmia przewalskii F. Mor.
Forcellinia wasmanni Mon.	Ants: Camponotus ligniperdus Latr., Formica sanguinea Latr., Lasius fuliginosus Latr.
F. gigantonympha Vtz.	Ants: Camponotus sp.
Acotolydon paradoxa Ouds	Bat.
A. krameri Berl.	Ants. Different mites of the family Parasitidae.
Caloglyphus rodionovi A.Z.	Hardback beetle: Tenebrio molitor L. Flour moth: Ephestia kuhniella Zell. (larva).
C. moniezi A.Z.	May bug: (Melolontha sp.).
C. polyphyllae A.Z.	Marble cockchafer: (Polyphylla fullo L.).
C. spinitarsus Herm.	Wasp: Osmoderma eremita Scop. Beetle: Carabus nemoralis O. F. Müll.
C. geotruporum A.Z.	Dung beetle: Trypocopris vernalis L.
C. berlesei Mich.	Marble cockchafer: (Polyphylla fullo L.). Rhinoceros beetle: (Oryctes nasicornis L.)
C. mycophagus Mégn.	Different millipedes, woodlice, and small beetles. ? cricket: Liogryllus campestris L.
Rhizoglyphus echinopus F. & R.	Beetles of the family Rhizophagidae. Flies: Merodon equestris F., Eumerus sp. Scatopse sp.
Histiogaster ocellatus Vitz.	Bark boring beetles: Xyleborus pfeili Ratz.

Species of Mite	Transporter
H. filippovi A.Z.	Bark boring beetle: Ips duplicatus Sahlb.
Monieziella corticalis Mich.	Dung beetle: Trypocopris vernalis L.
M. javensis Ouds.	Beetles of the family Brenthidae: Trachelizus bisulcatus F.
Lackerbatieria cribratissama A.Z.	Wasp: Crabro fossorius L.
Troupeauia nova Ouds.	Elephant beetle: Hylobius abietis L. Wasp: Crabro solenius L.
T. crabronickola A.Z.	Wasp: C. dives Lep., C.spinicollis H.S.
T. novisimilis Vitz.	Beetles of the family Brenthidae: Barynhynchus latirostris Gyll., Prophthalumus bourgeoisi Power, Hypomiolispa exarata Desbr., Caenorhynchodes serrirostris F., Rhyphidorhynchus longimanus F.
Rodionovia inopinata Vitz.	Cossonus linearis L.
Schulzea pamirensis A.Z.	Bee: Megachile grombzevskii F. Mor.
S. caucasica A.Z.	Bee: Prospopis sp.
Froriepia vimariensis Vitz.	Ant: Lasius fuliginosus Latr.
Tyroglyphus vethi Ouds.	Dung beetles: Phanaeus sp., Heliocopris sp.
T. submarinus Vitz.	Sea snake: Platurus colubrinus L.
T. macgillavryi Ouds.	Cockroach. Beetles of the family Brenthidae: Trachelizus bisulcatus F., Caenorhynchodes serrirostris F. Hormocerus reticulatus F.
T. mayaorum Vitz.	Beetle: Brenthus deplanatus Gyll.
Family Saproglyphidae	
Ensliniella parasitica Vitz.	Wasp: Odynerus (Lionotus) floricola Sauss.
E. kostylevi A.Z.	Wasp: Odynerus (Lionotus) rossi Lep.
Calvolia heterocoma Mich.	Squirrel: Sciurus vulgaris L.
C. elisabethae A.Z.	Ellobius talpinus Pall. Mouse: Prometheomus shaposhnikovi Sat.
C. reticulata A.Z.	Bee: Osmia dalmatina F. Mor.
C. thraca Vitz.	A green fly.
C. calliphorae Vitz.	Bluebottle: Calliphora vomitoria L.

Species of Mite	Transporter
C. bulgarica Štorkán	Ants.
C. striata Vitz.	Bark beetles: Taphrorhychus sp., Pityogenes lepidus Wichm.
C. fusiformis A.Z.	Blastophagus minor Ratz.
C. elliptica A.Z.	Hylesinus fraxini Pnz.
C. nataliae A.Z.	Ips acuminatus Eichh.?
C. circumspectans Vitz.	Ips stebbingi Strohm.
Vidia lineata Ouds.	Bees: Megachile pilicerus Mor., M. sp.
V. undulata Ouds.	Bee: Prosopis conformis Först.
V. squamata Ouds.	Rat: Rattus jerdoni Blyth.
V. gussakovskii A.Z.	Wasps: Crabro fossorius L., C. impressus Sm., C. vagus F., C. solenius L.
V. popovi A.Z.	Wasps: Crabro clypeatus L., C. alatus Pnz., C. wollmanni Kohl., C. impressus Sm.
Family Glycyphagidae	
Subfamily Labidophorinae	
Labidophorus sciurinus Koch.	Squirrel: Sciurus vulgaris L.
L. desmanae A.Z.	Muskrat: Desmana moschata L.
L. mogerae A.Z.	Far East Mole: Mogera robusta Nehr.
L. talpae Kram.	Mole: Talpa europaea L. Dormouse: Muscardinus avellanarius L.
L. soricis Ouds.	Mice: Sorex araneus L., Crocidura sp., Neomys fodiens L. Mole: Talpa europaea L. Water rat: Arvicola amphibius L. Field mice: Microtus oeconomus Pall., Evotomys glareolus Schr. Mouse: Micromys minutus L.
Xenoryctes krameri Mich.	Mole: Talpa europaea L.
X. heptneri A.Z.	Mole: Talpa europaea L.
Myacarus hypudaei Koch	Field mice: Microtus arvalis L., Evotomys glareolus Schr. Mole: Talpa europaea L. Mouse: Crocidura lasiura Thos.

Species of Mite	Transporter
M. arvicolae Duj.	Field mice: Microtus subterraneus Selys., M. arvalis L., Evotomys glareolus L. Water rat: Arvicola amphibius L. Hamster: Cricetus cricetus fuscidorsis Arg. Small hamster: Cricetulus migratorius Pall. Lemming: Lagurus lagurus Pall. Striped squirrel: Eutamias asiaticus orientalis Bonn. Mole: Talpa europaea L. Shrew mouse: Sorex araneus L.
Subfamily Chaetodactylinae	
Sennertia cerambycina Scop.	Bees: Xylocopa violacea L., X. valga Gerst., X. varentzovi Mor., X. nitidiventris Sm., X. przewalskii F. Mor., Osmia princeps F. Mor., O. macroglossa Gerst., Megachile argentata F., Anthidium christofi F.Mor. Wasp: Polochrum repandum Spin.
S. dissimilis A.Z.	Bee: Xylocopa dissimilis Lep.
S. cantabrica A.Z.	Bee: Xylocopa cantabrica Lep.
S. gargantua A.Z.	Bee: Xylocopa valga Gerst., X. punctilabris F. Mor.
S. alfkeni Ouds.	Bee: Xylocopa kalinovskii Rad., X. circumvolans Sm.
S. horrida Vitz.	Bee: Xylocopa dissimilis Lep.
S. zhelochovtsevi A.Z.	Bee: Xylocopa olivieri Lep.
S. potanina A.Z.	Bee: Xylocopa pictifrons Sm.
S. oudemansi A.Z.	Bee: Xylocopa dissimilis Lep.
S. bifilis Can.	Bee: Xylocopa combinata Rits.
S. simplex Trägh	Bee: Koptorthosma nigrita F.
S. morstatti Vitz.	Bee: Koptorthosma nigrita F.
S. perturbans Vitz.	Bee: Koptorthosma nigrita F.
S. caffra Vitz.	Bee: Koptorthosma caffra L.
S. hipposideros Ouds.	Bee: Platynopoda tenuiscapa Westw.
S. koptorthosmae Ouds.	Bee: Platynopoda tenuiscapa Westw.
Chaetodactylus osmiae Duf.	Bees: Osmia rufa L., O. tricornis F., O. kohli Ducke, O. dimidiata F. Mor.

Species of Mite	Transporter
Ch. réaumuri Ouds.	Bees: O. panzeri F. Mor., O. leucogastra F. Mor., O. emarginata Lep.
Ch. birulai A.Z.	Bee: Chelostoma florisommis L.
Ch. claviger Ouds.	Bee: Osmia tricornis F.
Ch. megachilarum A.Z.	Bees: Megachile bombycina Rad., M. ligniseca Kg. Wasp: Pseudovespa germanica L.
Ch. ludwigi Trouess.	Bee: Lithurgus dentipes Sm.
Ch. anthidii Ouds.	Bee: Anthidium stricticum F.
Horstia ornata Ouds.	Bee: Xylocopa circumvolans Sm.
H. helenae Ouds.	Bees: Xylocopa dissimilis Lep., Platynopoda tenuiscapa Westw.
H. trifilis Can.	Bee: Xylocopa combinata Ritz.
H. pulcherrima Vitz.	Bee: Xylocopa ordinaria Sm.
H. glabra Vitz.	Bee: Koptorthosoma nigrita F.
Neohorstia mamillata A.Z.	Bees: Anthidium pubescens F. Mor., A. laticeps F. Mor.
Tortonia intermedia Ouds.	Bees: Osmia leeana Kirby., O. solskyi F. Mor., O. nigriventris Zett. Nyl., Stelis phaeoptera Latr.
T. fluctuata Ouds.	Bumble bee: Bombus proteus Gerst.
T. smitsvanburgsti Ouds.	Bee: Anthidium sticticum F.
T. dogaressa A.Z.	Bee: Anthidium 7-dentatum F.
Sennertionyx manicata Giard.	Bees: Anthidium manicatum L., A. florentinum F., A. cingulatum Latr., A. diadema F., A. oblongatum Latr.
Cerophagopsis skorikovi A.Z.	Bees: Megachile döderleini Fr.
Cerophagus granulatus Duj.	Bumble bees: Bombus lapidarius L., B. terrestris L., B. argillaceus Latr.

Often among the Tyroglyphoidea, one comes across dispersal of the adult mite by means of animals, i.e. imaginal phoresy. The known cases are collected into the following table:

Species of Mite	Transporter
Family Tyroglyphidae	
Tyroglyphus farinae L.	Cat: Felis domestica L. Water rat: Arvicola amphibius L. Mouse: Mus musculus L. Rat: Epimys norvegicus Berk. Starling: Sturnus vulgaris L. Pigeon: Columba livia L. Sparrow: Passer domesticus L.
Tyrophagus "putrescentiae" Schr.	Bat: Myotis dasycneme Boie.
Tyrophagus noxius A.Z.	Rat: Epimys norvegicus Berk. Mouse: Mus musculus L. Sparrow: Passer domesticus L.
Tyrolichus casei Ouds.	Mouse: Mus musculus L.
Povelsenia neotropica Ouds.	Dung beetle: Phanaeus sp.
Ebertia australis Ouds.	Dung beetle: Phanaeus sp.
Caloglyphus polyphyllae A.Z.	Beetle: Polyphylla fullo L.
Olafsenia trifolium Ouds.	Dung beetle: Heliocopris bucephalus F.
Family Saproglyphidae	
Nanacarus minutus Ouds	Bat: Eptesicus serotinus Schreb. Mouse: Sorex vulgaris L. Bee: Platynopoda tenuiscapa Westw.
Family Glycyphagidae	
Glycyphagus destructor Schr.	Rat: Epimys norvegicus Berk. Mouse: Mus musculus L. Sparrow: Passer domesticus L., Capella solitaria Gr.
Glycyphagus domesticus Deg.	Pigeon: Columba livia L. Starling: Sturnus vulgaris L. Blackbird: Turdus musicus L.
Aëroglyphus peregrinans Berl.	Bees: Xylocopa violacea L., X. valga Gerst. Bumble bee: Bombus lapidarius L.
Nycteriglyphus pterophorus Berl.	Bat: Nyctalus noctula L.
Labidophorus sciurinus Koch.	Squirrel: Sciurus vulgaris L.

Species of Mite	Transporter
Labidophorus desmanae A.Z.	Muskrat: Desmana moschata L.
Xenocastor fedjushini A.Z.	Beaver: Castor fiber vistulanus Matsch.

In the last-mentioned case, the symphoric relationship with the host verges on the permanent epizoic method, which is facultative in species of the genus Labidophorus and possibly normal or obligatory in Xenocastor. The possibility of an endozoic method of dispersal by the Tyroglyphoidea has been only recently established (Bulanova 1936); it appears that all the eggs of barn species so far studied in this connection (Tyroglyphus farinae L., Caloglyphus rodionovi A.Z., Tyrophagus noxius A.Z.) are particularly viable; to a certain extent the resting hypopi of Glycyphagus destructor Schrank can pass, with the food, through the alimentary canal of mice and are excreted without losing their viability, whereas other stages died or were digested.

Man plays an important part in the dispersal of the Tyroglyphoidea. Owing to their practice of inhabiting the basic food materials (flour, grain, forage, seeds), they come in contact with many aspects of the domestic activities of man, and are widely distributed by him in infected food, agricultural and farm transport equipment, domestic animals, etc. Each of these methods of dispersal varies in its importance in different species; in many species, phoresy by the hypopi is one of the most important, (or even the only method), other methods being used to a small extent or even excluded completely. Such is the case in practically all the nidicolous species, i.e. in all the Chaetodactylinae, Labidophorinae, many Saproglyphidae and some Tyroglyphidae (Kuzinia, Forcellinia wasmanni etc.). Also species of the genus Caloglyphus etc. which are biologically associated with beetles a n d have special plate-like "hairs", and many other forms, particularly species of the obese and sluggish Rhizoglyphus. In other species the main method of dispersal is imaginal phoresy (genera Nycteriglyphus and Aëroglyphus). A third method utilises air currents (anemophoria) or uses them in conjunction with independent migration (Cometacarus, Glycyphagus, Tyrophagus);

some species make use of all the above methods (Tyroglyphus farinae); finally, there is a series of synantropic forms, the dispersal of which is almost entirely brought about by human beings (Thyreophagus, Gohieria fusca, Aleuroglyphus sp., Blomia and Chortoglyphus.

Reproduction: The literature related to the fertility of the Tyroglyphoidea is very scanty and deals exclusively with the barn species. According to the data available, the total number of eggs laid by one ♀ Tyroglyphus farinae L. is 20 to 30, in the case of Tyrolichus casei Ouds. and Rhizoglyphus echinopus F. and R. about 100, Caloglyphus rodionovi A.Z. about 621, Gohieria fusca Ouds - 11 to 24, Glycyphagus destructor Schrank - 8 to 10. The number of eggs produced is very variable and dependent on external conditions; e.g. in C. rodionovi it may vary from 3 to 620. The time of individual development in the same species also varies in the same way, temperature being one of the most important external characters; at an optimum humidity the life cycle takes 6 to 28 days (at 16.5 to 18°C. it is 28 days, at 24° - 11 days, 24.7° - 10 days, at 25.5° - 9 days, at 29.5° - 6 days, at 30.8° - 5 days); the life history of Rhizoglyphus echinopus fluctuates from 9 to 27 days).

In accordance with the great variation in the factors governing fertility, the ability to reproduce is different in different species of the Tyroglyphoidea.

The following table was compiled from results obtained by O.K. Nastukova and it shows the average number of individuals produced by one individual one month from the date of starting the experiment, and gives some idea, although not complete, of the difference in ability to reproduce met with in different species, as well as its variation under different external conditions in the same species.

Temperature in °C	80%			90%		
	Tyroglyphus farinae L	Aleuroglyphus ovatus Tr	Tyrophagus noxius A.Z	Tyroglyphus farinae L	Aleuroglyphus ovatus Tr	Tyrophagus noxius A.Z
7- 8	1.28	-	-	7.69	-	-
10-11.5	-	0	0.64-1	-	0.23	2.16
13	35.25	-	-	35.89	-	-
15-15.5	-	0.14-0.31	5.7	-	0.14-0.31	16.6
22-22.5	48.58	0.77-1.4	17.5	173.07	1.98-4.11	60.7
25-25.5	58.33	2.31-2.83	40.0	57.69	4.8 -8.5	243.0
30	2.58	6.37	39.8	-	22.87-25.4	190.0
35	0.0	7.57-7.64	0.0	0.0	35.04-52.08	9.9

An important factor, apart from the physical factors of the medium, in determining the survival potential of the Tyroglyphoidea, is the existence of numerous predators, particularly those belonging to the family Cheyletidae - (primarily Cheyletus sp., Acaropsis sp., Cheletomorpha and Cheletophyes) which are specific consumers of the Tyroglyphoidea and occupy the same habitat; they are also destroyed by other predators - representatives of the families Laelaptidae and Parasitidae and sometimes by the predaceous larvae of some insects, e.g. Arthrocnodax sp.

Economic Importance

The great economic importance of the Tyroglyphoidea detricolae is shown by the fact that all barn species of economic importance belong to this group, which harms agricultural stores. There is hardly a stored produce unaffected to a greater or lesser extent by their attack, but the greatest economic damage is that of the mass destruction of grain and grain derivatives, also that done to oil-producing seeds, bulbs and tubers. With a normal seed humidity (up to 17%), the mites damage the embryo which, according to all authors, seems to attract them. They penetrate the seed through cracks and tears in the outer covering at the embryo end, and eat away cavities, where further development and multiplication takes place. As increase in numbers occurs (there may be 200 individuals in one seed), the cavity is enlarged until the embryo is completely eaten away. The mites then start feeding on the endosperm, or else migrate to another seed. The endosperm tends to get damaged when the humidity is high, as this causes swelling and softening. In some cases the whole content of the seed is destroyed, the outer covering containing only mites, their carcasses, cast skins and excrement. The degree of destruction is conditioned by many factors: the density of mite population, the time available for destruction, the condition of the seed and storage conditions. According to available data, under growers' conditions the number of grains attacked by the mites,

even when present in low concentration (first and second degree of contamination) reacnes, after several months of storage, 30-32%; in the third degree of contamination and a longer period of time, all seeds may be damaged to a greater or lesser extent in individual cases. Note: The first degree of seed contamination by mites is one where their number does not exceed 20 individuals in the sievings from a kilogram sample of seeds; the second degree is when there are more than 20 but not a continuous moving mass; the third degree is the presence of mites in such numbers that they do not run about but form dense mobile lumps.

No less important than the direct damage to the grain (by eating it away) is the indirect harm resulting from mites living in it. This aspect of their harmful influence - extent of which is difficult to assess - is shown by the contamination of the grain, the raising of its moisture content, the generation of heat, and the appearance of bacterial and fungal infections. Such effects of the mites' activities lead to (1) the filling in of the spaces between the grains with a mass of mites, their cast skins and excrement (which causes a sticking together of the grains and thereby hinders the circulation of air throughout the stacks); (2) the mites are vectors of fungal and bacterial diseases and spread them throughout the whole mass of the grain; in addition, it is believed that the mite excrement acts as a food substance for different bacteria, and therefore accumulations of mites are a means of contaminating grain with bacteria. Finally there is evidence that mite damage activates the living process within the grain (its respiratory and fermentative process) and even causes the development of damp and warmth.

The results of the destructive activity of the mites in grain are many. Primarily there is gradual fall in germinating capacity, obviously corresponding to the amount of damage done to the embryo by the mites. In the case of a large concentration of mites (third degree of contamination), the capacity of wheat to germinate, according to Sokolov, was lowered very rapidly to 54% in 30 days under laboratory conditions. A

similar infestation in rye lowered the germination capacity by 51% in 67 days, etc. The rate of falling also depends to a great extent on the original humidity of the grain; thus, according to Rodionov, in 60 days infected wheat at 70% humidity lost 13 to 15% of its germinating power, whereas at 14.8% it lost only 6 to 8%. Undoubtedly temperature also plays a great part, by affecting the rate of multiplication and vital processes, and therefore the detrimental activity of the mites. Besides lowering its germinating powers, the absolute weight of mite-infected grain is also reduced to a certain extent, (in Sokolov's experiments, wheat contaminated to the second degree lost 5% of its weight in a month); the grain also undergoes a series of changes in chemical composition; thus after one month infected wheat has its fat content of 1.71 to 1.84 reduced to 1.3 to 1.52%, its protein from 11.87-16.42 to 10-10.62%, and starch from 60.14 to 56.4%. At the same time it increased its humidity from 11 to 13%. Flour prepared from contaminated grain has a higher moisture content, a higher hygroscopicity, is more acid and tends to stick together; it has a fusty or even stagnant smell and a bitter taste, and its baking properties deteriorate (Sokolov and others). Tyroglyphus farinae L., Tyrophagus noxius A.Z., and T. perniciosus A.Z., are the most serious destroyers of grain. The nature of the damage done by these mites to flour and other grain products is also very varied; besides eating the flour, they also cause spontaneous "wetting", and infection with micro-organisms which quickly leads to a spoiling of the flour and a lowering of its nutritive and baking qualities; after a time it begins to cake, becomes dark in colour, smells unpleasant, and is not suitable to use. Coarse flour is often completely eaten away by the mites, leaving the chaff untouched. Aleuroglyphus ovatus Tr., Tyrophagus and Gohieria, as well as the flour mite, are particularly bad for flour. The damage done to oil-producing seeds is, on the whole, of the same character as that done to grain, and the nature of the damage varies with the condition of the seed and its condition of growth; the same mites damage these seeds, as well as Tyrolichus casei Ouds., Caloglyphus rodionovi A.Z.,

and others.

Very great losses are caused by mites belonging to this group and many others, to other food commodities, e.g. to dried fruit and vegetables, to cheese, etc.; according to American statistics, the cheese industry in the U.S.A. loses 3,000,000 dollars every year owing to damage by mites. Of very serious economic importance is the loss caused by the Tyroglyphoidea to vegetable and flour production. The bulb mite - Rhizoglyphus echinopus F. and R. is of major importance, as it attacks the bulbs of all kinds of decorative and vegetable plants, the tubers of potatoes, beetroots and other root vegetables, not only in the earth, but also in storage. It makes tunnels in between the scales of hyacinth, tulip bulbs, narcissi, lilies, irises, which penetrate far into the bulb, touching the embryo shoot which is often consumed away; when infection is great, the areas eaten by the mites reach a considerable size and, when the bulb is opened, it is found to be filled with a brownish or black frass consisting of all developmental stages of the mite, their cast skins and excrement. The direct result of mechanical damage caused to the tissues by the mites leads to desiccation of individual parts of the bulb, secondary damage is also caused by the invasion of the damaged surface by pathogenic fungi and bacteria (the spores of which are carried by the mites during their migration from one bulb to another). The damaged bulb soon becomes soft, it decays and becomes infected by a rich saprophytic flora, as well as by Nematodes and the larvae of various flies. If the bulbs are kept under conditions conducive to the multiplication of mites (at a sufficiently high temperature), they are destroyed during storage; if, however, the detrimental activity of the mites is hampered by storage at low temperatures or occurs later during germination, or on planting in the earth, various pathogenic symptoms become evident on the mature plant. In the lily ("Lilium harrisi"), for example, the disease known as "basal rot" can be observed (Ogilvie 1929); Scalia, in contaminated specimens of Lilium tigrinum, has observed spots followed by a complete withering of the leaves and of the whole plant in spite of copious watering; more

often the attacked plant does not show any sign of disease for a long time and then dies.

The degree of damage caused by R. echinopus to the bulbs of various decorative plants is not constant; narcissi and also lilies suffer particularly badly, owing to their loose fitting scales, which make it easier for the mites to enter the bulbs. Bulbs with more densely packed scales, such as tulips and hyacinths, suffer less from the attacks of this mite.

The extent of bulb damage caused by R. echinopus is shown by the following examples. According to Woods, from 20 to 60% of the total yield of bulbs from a large plantation of Lilium longiflorum v.examium (= L. harrisi) on the Bermuda Islands perished during germination owing to the activity of this mite. Garman (1923), who examined about one million bulbs imported into the U.S., showed that, on an average, 15 to 20% were infected with Rhizoglyphus; Hudson, who examined 500 samples, each containing 6 to 20 Narcissus bulbs from Holland and Great Britain, found that 85% of these were infected with bulb mites. In the literature cases are recorded in which 100% of the bulbs perished.

The damage done by this species to onions is also very great and of a similar character. According to Popov (1929), entry of the mites into the bulb takes place through that region which is not suberised, because they are incapable of penetrating the parchment-like covering. At the beginning of damage, the basal part becomes fragmentary, loses connection with the bulb itself, and then falls away easily, leaving bare the internal parts. The mites then penetrate between the scales, which separate, become brown, begin to rot, and in one to two months the bulb is completely destroyed; the turnip onion is destroyed rather more quickly, because it has fleshier scales and contains more water. The extent of the damage caused by the mite to onion can be seen from data supplied by the same author, according to whom, in the Tartar region of the U.S.S.R. in 1925-6, about 40 to 50% of the bulb stores were destroyed during the winter months.

The damage done to the tubers of potatoes and dahlias is very

similar in character to that done to onions. According to Appel, Börner (1905) and Zacher (1927), it usually appears as irregular burrows penetrating the inside of the tuber from a damaged part on the surface; these burrows are filled with loose, flour-like material full of mites in all stages. Potatoes are attacked in the field as well as in store. Decaying tubers are particularly prone to attack, but the mites will also burrow into healthy tissues; according to the same authors, the following varieties of potato are more susceptible - Richless Imperator - a yellow table potato, Irene and Sophia.

One should note that some authors, e.g. Maurizio 1906, doubt whether Rhizoglyphus can attack completely healthy tissues; these doubts are based on the fact that infestation is often combined with attack by Nematodes (Heterodera rostochiensis Woll. Zimmerman 1920) and other pests. However, Zacher states definitely that tubers which are already mechanically damaged are attacked.

Rhizoglyphus echinopus, together with some other species (Heteroglyphus vitium Foa and R. minor Down.), damages cultivated grapes by attacking their roots. According to Mangin and Viola (1900, 1902), Petri (1928), Silvestri (1902), and other authors, the bushes which are attacked by this mite are, in the first place, those which are weak and unhealthy; after that, the mites migrate to healthy plants. Here Rhizoglyphus is usually found in association with Phylloxera and is localised mainly on swellings and enlargements of the roots (these are formed as a result of the activity of the mites); the mite is also found on young roots, where it bites out passages, gradually penetrating into healthy tissues and causing them to die. This damage greatly influences the whole development of the bush, as the pattern of growth is destroyed, the stem develops irregularly, the leaves remain small and thereby decrease the assimilating surface. In the first year of infection, the bunches of grapes do not ripen and subsequently become smaller and smaller with the progress of the disease; the mite burrows penetrate further into the roots, and when they reach the pith the bush dies - usually in the third to fifth year after infection by

the mites.

The damage done by Rhizoglyphus to the roots of vines, in some areas facilitates the damage done by other pests. Petre (1929) considers that it allows the Phylloxera to reach the internal layers of the main root epidermis, thereby accentuating the effect of the damage. According to Dermentiev (1913) R. echinopus (wrongly called by him R. caucasicus) is also one of the mites which causes chlorosis of grapes in the Caucasus.

Some part is played by the Tyroglyphoidea in damaging field crops; cases can be cited of damage by Rhizoglyphus to the underground parts of cereals (wheat, oats - Reuter 1901, Tullgren 1916), and there are individual examples where serious damage has been done by Tyrophagus (humerosus group) to wheat (Schoevers 1926).

Finally, serious damage is done by representatives of the same family (Forcellinia fungivora Ouds., F.(?) lintneri Osborn, Acotyledon sp.) to mushrooms in hothouse culture. Cases of loss caused by Histiogaster bacchus A.Z. to the production of wine vinegar and by Carpoglyphus lactis L. to some varieties of wines should be noted. Another aspect of the activity of the Tyroglyphoidea is shown by the pathogenic effect to humans and domestic animals due to swallowing the mites. They may induce acute stomach and intestinal disease or catarrh and asthma in the respiratory tract (Rodinov 1936); in addition, some representatives of this group (e.g. Rhizoglyphus echinopus F. and R.) may cause the appearance of specific dermatitis in people in continual contact with contaminated products (Pavlovsky and Stein 1930). Also cases of endoparasitism have been recorded concerning two species - Histiogaster spermaticus Trouess. and Carpoglyphus alienus Banks in the human urinary and genital tracts.

Methods of Control

In this chapter, only the general principles of the control of the Tyroglyphoidea, which are applicable to the more important products

liable to be attacked, will be discussed. These principles are treated in greater detail in a series of special works, and particularly thoroughly by P.K. Chernyshev ("Mites which harm agricultural stored products of the U.S.S.R." - Selkolkozgiz 1938. In compiling the present chapter, the author consulted P.K. Chernyshev and Z.C. Rodionov, who kindly put at his disposal a series of unpublished data, and who also read the proofs).

1. Grain

All the methods for protecting grain against mites may be divided into three groups:

(a) prophylactic methods - directed towards the prevention of grain contamination by mites;

(b) hygienic methods - which prevent the multiplication of the mites in the grain during storage;

(c) destructive methods - which can be further subdivided as follows:

(i) single action, e.g. by gas;

(ii) more lasting action, e.g. by powdering the grain with dry acaricides.

More often they are subdivided into physical-mechanical, as opposed to chemical methods.

Owing to the wide distribution of grain mites in the field (at least in most districts), and owing to their diverse methods of distribution, the protection of grain from contamination must start long before it is stored in granaries and elevators. It must take place at every step of grain production, and at every stage that the grain has to go through, from the time of reaping to the moment when it is poured into bags for storage - it must also include all the objects with which the grain comes in contact. When the grain is harvested by combines, the first step that must be taken is the careful cleaning of the machine from the dust and chaff which settles on it. It is particularly important to do this before harvesting, because even a small accumulation of detritus in bunkers and nets from a previous harvest may be contaminated

with mites and serve to re-infect the new one. Similarly, all motor lorries used in the transport of grain should be periodically cleaned.

When field distribution points are used (reloading centres), a lot of attention must be paid to keeping them clean; their sites must be changed frequently (because chaff and spillings inevitably collect there and become infected), and when a new one is chosen care must be taken to choose one where conditions are unsuitable for mite development. Thus the sites should be dry, well cleared of growing plants and plant remains. If it is necessary to cover the grain with straw, choose fresh dry straw, and avoid any which has been left lying about in fields. It is obvious that grain left heaped in the open for a long time will run a greater risk of being contaminated, the amount being proportional to the time that it is left exposed. (If the grain is left long in the field, it can become contaminated by rodents and insects visiting the grain.)

Harvesting by means of ordinary agricultural machinery, followed by threshing and cleaning of the grain, exposes the grain to a greater risk of infection than when a combine harvester is used, owing to the greater time of exposure. Contamination may occur when the corn has been collected into stooks when the humidity is high, but it is more likely to occur in the lower levels of the ricks, i.e. in those which are nearest to the earth. The danger of contamination also increases in direct proportion to the time that a rick is left standing, as well as being dependent on the preparation of a site. If a rick is built on a new, dry, well-cleaned space in the open, the danger of infection is considerably less than when the rick is built on weeds, on a grassy surface, on the lower levels of a field, or in particular, on an old threshing floor. Of definite importance is the visiting of ricks by mice, as they can carry many different kinds of mites.

During the threshing and cleaning of the grain, the machinery should be kept in a hygienic condition. Also the drum should be correctly regulated during threshing, so that the seed coat remains unbroken and therefore less likely to be attacked by mites. The threshing

floor should also be regularly cleaned; if this is used for a long time without cleaning, it becomes caked with mites mixed up with earth; transport vehicles should also be cleaned. Generally speaking, a quick harvest, with a constant care for cleanliness of every object with which the grain comes in contact, should reduce the danger of contamination of the grain in its progress from field to granary.

The preparation of the granary for the new harves is of great prophylactic importance. It should be carefully cleaned of rubbish, sweepings and dust, then dried and treated chemically; precautions should be taken to prevent mites from being brought in from outside. For the decontamination of grain containers, the room is usually sprayed with a solution of caustic soda, an emulsion of mineral oils, lime etc.; in some cases one has to fumigate with chloropicrin. To protect buildings from outside contamination, space near the stowage should be kept clear of refuse, also protected from rodents and birds; also infected goods should not be stored in its proximity. The same precautions should be observed during prolonged storing of grain.

Prophylactic methods against infection and increase in number of mites are considered in the light of the afore-mentioned biological pecularities of these pests: also by consideration of their hygrophylic, thermophylic and anemophylic characters and their association with a saprophytic microflora. It is clear that control of the mites can be attained if precautions are taken to maintain a low temperature, low humidity, sufficient ventilation and a low rate of activity of microbiological processes. The whole system of storage should be directed towards maintaining healthy grain under optimum storage conditions. The aim of all these operations is therefore (a) the maximum cooling of the grain, (b) the drying of the grain (c) the removal of conditions which bring about self-humidifying and self-heating, i.e. fluctuation of temperature, inadequate ventilation and access of damp air, etc. There should be close co-ordination between the problem of control of the mites on the one hand, and correct storage of grain on the other; every operation which leads to the maintenance of healthy grain - drying,

cleaning, cooling, adequate ventilation, is of basic importance in the control of the mites, and lowers the possibility of their mass increase. A rational construction of the granary is also of importance in protecting the grain.

Practically all steps taken to maintain the health of the grain, also destroy the mites. Thus, the drying of the grain (in the sun, as well as by artificial heat), not only lowers the humidity (thus making it more difficult for the mites to develop), but also kills a large number of mites, as a result of raising the temperature and by dehydration. The turning of the grain with shovels, which is done to reduce its temperature, also kills large numbers of mites through mechanical action. During the cleaning of the grain on different types of machines, large numbers of mites are separated out by the current of wind in the ventilators, and many are crushed by moving grain. These methods of control have been used with great success against mites, and they form the basis of a series of measures taken to decrease their numbers. Thus various types of specially constructed drums - "mite beaters" - have been constructed, but these, unfortunately, are liable to damage the grain, thus making it more easily infected, unless careful adjustment of the machinery is maintained.

A special method of thermal drying has been devised which has an increased destructive effect, but its application in practice is limited by the fact that a quick and sudden increase in the temperature of the grain (which is the basis of this method) has a detrimental effect and lowers its germinating power and depreciates its baking qualities.

Of the chemical methods of combating mites, the most popular is the fumigation of grain and storage buildings with chloropicrin; the main advantage of this method is its quick obvious effect, and its high toxicity to all active stages. Unfortunately its advantages are offset by the great resistance of eggs to it (100% destruction of which can only be obtained at high concentrations and long exposure - 125 gm. per cubic metre for a week - conditions which cannot be applied on a large scale); also, hypopial forms are resistant to it, so that re-

infection could begin again 8 to 15 days after fumigation. Other disadvantages are the lowering of capacity to germinate after fumigation (especially great if the humidity is high), the difficulty of decontamination, as well as the danger of working with such a strong poison. As a result, chloropicrin is only used in special cases and cannot play an important part in control. Fumigation of grain intended to be used as seed is strictly forbidden. In addition, carbon bisulphide - CS_2 - can also be used; it penetrates the thickness of the piles of grain, does not reduce its powers of germination, and is easily removed. But CS_2 is very inflammable and apt to explode, so that its use is limited, and, in large towns, forbidden. In recent years, other poisons such as sulphuretted hydrogen - H_2S, potassium cyanide - KCN, have been suggested, but it is at present impossible to say what the prospect of using these chemicals is likely to be.

Powdered acaricides can also be mixed with the grain; some of these (e.g. vivianit, chalk, superphosphate and talcum) are contact poisons, others (naphthalene, paradichlorobenzene) are fumigants; they not only destroy mites already present, but protect the grain for a long time from future reinfection.

The use of acaricides is not widespread as yet, and is hampered by insufficient knowledge. Naphthalene has been the one most extensively used, but only for seed grain, as it leaves a sharp unpleasant smell to grain used as food.

One should also mention the possibility of using ultra short waves against mites, but this method has not yet been sufficiently investigated. It is also not quite clear how biological methods could be utilised: specific predators such as the Cheyletidae, which destroy the Tyroglyphoidea (and also therefore must possess a higher ecological valency than the latter), could be made use of. However, the results obtained do not give rise to optimism, because a positive effect is only attained in the case of a certain numerical relationship existing between the predator and granary mites at optimum temperature, and it depends on other measures controlled with difficulty.

The above methods of mite control and grain protection are not of equal value. There is no doubt that, in all rational systems, a leading part is played by prophylactic methods, i.e. those in which the grain is kept under ecological conditions which prevent multiplication of the mites. This fact becomes increasingly important in the case of mites attacking stores, as successive generations of mites occur very rapidly under suitable conditions, and any control measures carried out only once are of negligible importance. Owing to the close relationship between mite control and the pest-free storage of grain, it is obvious that a rational storage of grain, accompanied by strict prophylactic hygiene, is the most effective way of controlling the granary mites.

2. Flour and other products obtained from grain

The control of mites in flour, semolina and other farinaceous products presents great difficulties and has not been worked out. Therefore it is recommended that the period of storage should be limited and the prophylactic methods given above carried out.

3. Vegetables

The control of mites on tubers and root vegetables also involves a strict attention to hygienic methods. Such measures must begin immediately the crops are collected, because the condition of the crops determines whether they will be attacked by mites. Harvesting must not be delayed, and the crops should be removed in good time to prevent mechanical damage (of potatoes and vegetables during digging up and transporting); they should also be adequately dried. Before the products are stored, storage places should be prepared (by cleaning and by the disinfecting of empty buildings and cellars adjoining the stores); the products themselves should be carefully sorted out - any damaged bulbs or tubers removed - and divided according to destination and kind. Owing to the high water content of all root and tuber products, of particular importance in their storage is the maintenance of a definite

temperature and the organisation of correct ventilation. For the storage of most vegetables, the best temperature is from 1 to 2°C., which prevents the possibility of mite increase.

Note: Seed onions should be partially dried and stored at 18 to 20°C. In addition, the place where sorting takes place should be periodically cleaned and disinfected, and any remaining detritus, such as dirt, decaying materials, etc., should be destroyed (before destroying they must be decontaminated with a suspension of lime). Storage place floors should be covered from time to time with lime, in order to destroy mites imported from outside and prevent them spreading. Badly contaminated products should be isolated from healthy ones.

The control of mites attacking vegetables has not been sufficiently developed. Some methods have been fairly widely applied to onions, garlic and to decorative bulbs in particular, as they suffer widely from mite attack. Fairly good results have been obtained by immersing bulbs in water heated from 42 to 50°C. for three minutes; when this is carefully carried out, the mites perish and the bulbs do not lose their viability. According to English and American authors, it is possible to immerse the bulbs in a warm solution of nicotine sulphate and 2% formalin. Fumigation with carbon bisulphide and paradichlorobenzene is also recommended; also fumigation with sulphur dioxide is possible.

4. Dried fruit

Of the methods used for preserving dried fruit, the most important is fumigation with carbon bisulphide immediately before drying. In this way a better colour and bloom, in addition to other properties, are retained, and contamination by mites is prevented. The keeping of dried fruit with a high water content increases the danger of contamination.

Besides the above-mentioned physiological control methods, there is no doubt that one should utilize biological means, the study of which should be carefully considered.

The Collecting and Preservation of Mites

A survey of places inhabited by the Tyroglyphoidea gives one a general idea of where to collect mites belonging to this group. When such collections are being made, one changes the technique according to the substrate under consideration. The most common method of collecting consists in passing the substrate through a fine sieve and then removing the mites from the sievings. It is best to use two to three of the usual grain sieves (with a large and medium mesh); substrates which consist of large separate pieces (e.g. hay or dead leaves) are first cut up into small pieces with scissors and the moister parts allowed to dry slightly. The separation of the mites from the sievings can be done by hand, examining small portions under a binocular or fixed magnifying glass and then picking out the mites on the end of a moistened needle; alternatively, they can be extracted with a Berlese or Tullgren apparatus. The basis on which these pieces of apparatus work is the desire of the mites to leave a drying substrate; each consists of a funnel with a test tube fixed to it, which contains water (or a preserving fluid), and a sieve made from a fine metallic net which covers the wide part of the funnel. The sample to be examined is spread thinly on the sieve, the funnel is darkened and the whole apparatus placed in the sun, or heated above by a lamp for several hours, until the mites have entered the tube. In addition to sieving, substrate which cannot be sieved can be examined (with magnifying glass or binocular); mites (mainly hypopi) can be collected from fresh and preserved insects and mammals; the insects can be examined direct, the mammals by combing or shaking over black paper, or if working with preserved material, by filtering the spirit in the jars and examining the filtrate.

Collected mites are transferred into preserving fluid, or mounted. The best preservative is that of Oudemans:

87 parts by volume of 70% alcohol
5 " " " " glycerol
8 " " " " glacial acetic acid

but in an emergency 70% spirit can be used.

Permanent microscopic preparations can be made by mounting in Faure Berlese medium:

Distilled water	-	50	parts	by	weight
Chloral hydrate	-	200	"	"	"
Glycerol	-	20	"	"	"
Gum arabic	-	30	"	"	"

The gum arabic can be replaced by a cherry gum, but not by office gum, which is quite unsuitable. Addition of 5 parts by weight of cocaine hydrochloride is also recommended, but is not essential. In preparing this mixture, the gum arabic or cherry gum should be dissolved in the appropriate amount of water and glycerine, and chloral hydrate added to the solution. The mixture should be put in a warm place in a hermetically sealed jar and allowed to stand two days; then filter through glass wool, and it is ready for use. Mites can be mounted direct into this medium and the slide warmed slightly until the objects become clear. The slide must be kept horizontal while drying. This is the best mountant to use for mites. Its one disadvantage is that it makes the leaf-like setae of the legs too transparent and invisible, but this can be avoided by regulating the amount of warming; if this solution is not available, it is better to use glycerine jelly, having first cleared the mites in lactic acid. The usual entomological techniques for making microscopical preparations of insects are quite unsuitable for mites.

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List of Abbreviations Used in the Text

Parts of tarsi IV of o Tyroglyphidae

ab - distance between base of tarsus and proximal margin of first copulatory tarsal sucker.

cd - distance between both tarsal copulatory suckers.

ef - distance between the distal edge of the margin of second distal tarsal copulatory sucker and end of tarsus.

Setae of the idiosoma

an - setae anales

d - " dorsales

d_1 - " " primae.

d_2 - setae dorsales secundae.
d_3 - " " tertiae.
d_4 - " " quartae.
h - " humerales.
h e - " " exteriores.
h i - " " interiores.
l - " laterales.
sh - " subhumerales.
l a - " laterales (s. lumbales) anteriores.
l p - " " " posteriores.
l_1 - " " primae.
l_2 - " " secundae.
l_3 - " " tertiae.
l_4 - " " quartae
l_5 - " " quintae.
p - " postanales.
p_1 - " " primae.
p_2 - " " secundae.
p_3 - " " tertiae.
pr a - " preanales
sa - " sacrales.
sa e - " " exteriores.
sa i - " " interiores.
sc - " scæpulares.
sc e - " " exteriores.
sc i - " " interiores.
v - " verticales.
v a - " " anteriores.
v p - " " posteriores.
v e - " " exteriores.
v i - " " interiores.

Sensillae of the tarsi

alpha - main sensory rod.

beta - accessory sensory famulus.

gamma - proximal sensilla of basal group.

delta - distal sensilla of basal group.

epsilon - dorsal sensilla of medial group.

Systematic part

Key to the Families

A. Adults

1(2) Claws sessile, joined to the end of the tarsus by means of two special connecting sclerites; praetarsus fleshy, cushion-like and enveloping the base of the claw, or else reduced. ♂ with well developed anal suckers and two pairs of tarsal copulatory suckers (absent only in Scatoglyphus); ♀ without epigynia; genital suckers fingerlike; skin smooth, thin, membranous, colourless; idiosoma clearly divided by a transverse line into propodosoma and hysterosoma; setae of hystersoma never pectinate or leaflike.

1. Tyroglyphidae

2(1) Claws stalklike, placed on the end of a long praetarsus, not connected with the end of the tarsus by paired sclerites; ♂ without anal or tarsal copulatory suckers (if present, the genital opening is placed between the bases of leg I and the skin is considerably thickened), or with only 1 pair of tarsal suckers; ♀ often with an epigynium; genital suckers usually disclike.

3(4) Idiosoma always distinctly divided into propodosoma and hysterosoma; skin smooth or finely striated, of a delicate membranous consistency; all the setae of idiosoma and legs smooth and hairlike.

2. Saproglyphidae

4(3) Idiosoma not divided, if divided by a transverse groove, then the setae are either leaflike or bipectinate; the skin is of a thick, rather dense consistency and is more or less intensely coloured. Skin is rough, bears spines, or is thickly striated, seldom smooth; when smooth very considerably thickened; setae of idiosoma and legs variable in structure, rarely hairlike.

3. Glycyphagidae

B. Hypopi

1(2) Ventral surface of the body with a fixing apparatus which consists of a pair of mobile folds and, beneath them, two transversely ribbed clasps, adapted for gripping and holding the hairs of mammals; dorsal surface of the body flattened and smooth.

3. Glycyphagidae (subfamily Labidophorinae)

2(1) Ventral surface of the body with a sucking disc - a rounded plate bearing 3 to 5 pairs of fleshy suckers; dorsal surface more or less strongly convex; if flattened, however, it is then covered with dense parallel striations.

3(6) Praetarsi long, more or less stalklike, bearing the claw terminally.

4(5) Coxal fields III and IV closed along the midline of the body by a longitudinal linear sclerite; most species have a pair of semispherical protruding eyes on the propodosoma.

2. Saproglyphidae

5(4) Coxal fields III and IV open, separated from each other in the midline by a wide space; no eyes.

3. Glycyphagidae (subfamily Chaetodactylinae and Genus Hericia)

6(3) Praetarsi absent; the claw is therefore sessile.

7(8) Gnathosoma well-developed and mobile, the sternal setae are nearly always converted into suckers; hysterosomal shield overlaps the base of the propodosomal shield with its anterior edge; surface of both shields is finely punctate or pitted; genital "suckers" have rounded ends.

1. Tyroglyphidae.

8(7) Gnathosoma more or less reduced, fused with the idiosoma, or it is completely absent (in such a case represented only by one or two pairs of thin setae - arists); sternal setae not converted into suckers; hysterosomal shield does not overlap on to the propodosomal; surface of both shields is more or less reticulate, consisting of thin indented lines, or is covered with elongated pits; genital suckers have sharply pointed ends.

3. Glycyphagidae (part of subfamily Chaetodactylinae)

1. Family Tyroglyphidae[1]

Tyroglyphidae Ouds. 1932 + Caloglyphidae Ouds. 1932 + Tyrophagidae Ouds. 1924 + Forcelliniidae Ouds. 1934 + Rhizoglyphidae Ouds. 1923.

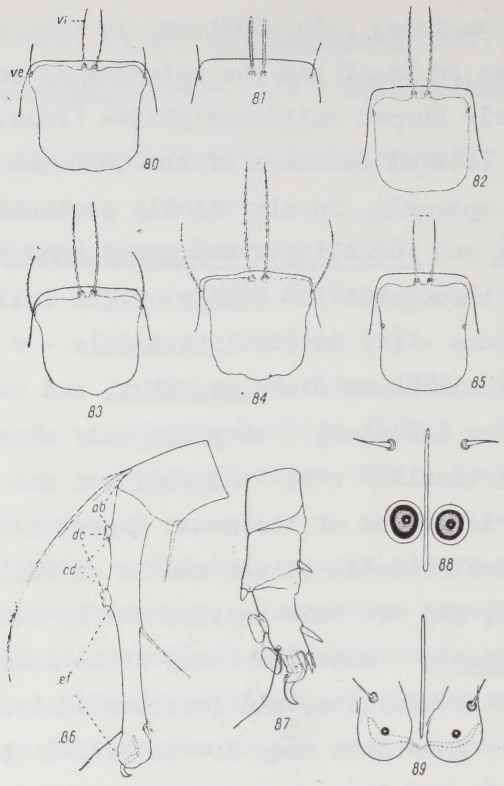
[1]Note: To this family the following insufficiently described species also belong:

Rhizoglyphus minor	Dementjev 1913	(Caucasus)
"	trouessarti Berlese 1897	(France)
"	eutarsus Berlese 1921	(Italy)
"	germanicus Berlese 1921	(Germany)
"	occurens Berlese 1921	(Italy)
"	algidus Berlese 1921	(Italy)

Characters of the family. The idiosoma is always clearly subdivided into propodo- and hysterosoma by a transverse groove running behind the base of leg II. It is strongly convex ventrally and dorsally, and, in transverse section, is broadly elliptical, almost round. In the living animal, longitudinal depressions can be seen (corresponding to the places of attachment of large dorso-ventral muscles and also the powerful retractors of the chelicerae); these become invisible in fixed specimens. In life, the idiosoma is white, semi-transparent, with a characteristic glossy lustre, sometimes with a grey-green tinge and diffuse spots - the dark colour of the intestinal contents. The skin is thin, soft, of a membranous consistency, colourless, transparent and, in most cases, absolutely smooth (very thinly wrinkled in the case of the ♂ only of Caloglyphus mandzhur); the propodosomal shield is always well-developed, occupying all the area of the dorsal surface of the propodosoma between v i and sc. It is broad, faintly pigmented and almost colourless; in some species of the genus Schwiebia, it is divided by a longitudinal, flat, soft, membranous piece of cuticle into two narrow, more or less independent shields (fig. 340), and in S. pachyderma it is not clear owing to a general thickening of the skin. In males of a large number of Rhizoglyphinae, the posterior part of the dorsal surface of the

hysterosoma is covered with a more or less densely pigmented opisthosomal shield (figs. 330, 327, 340), sometimes forming platelike or complicated fanlike expansions; in addition, in many species, the cuticle around the bases of leg I and the epimeres is somewhat thickened, forming irregularly shaped chitinous plates (figs. 257, 328).

On the dorsal and lateral surfaces of the idiosoma are 7 to 14 pairs of smooth, thin, sparsely, rarely thickly pectinate setae (thickly feathered in Kuzinia and Forcellinia wasmanni), the arrangement of which is very constant throughout the family. The following setae arise from the propodosoma - (1) internal verticals - v i: these are medially placed, with their bases close together, and vary little in length - 10 to 17% of the idiosoma; they are only absent in Moniezi-ella; (2) external verticals - v e: the position and size of which, on the contrary, is variable and of taxonomic importance (figs. 80 to 86). They are sometimes situated at the middle of the lateral edge of the propodosomal shield, and are then represented by thin, smooth, microsetae (Rhizoglyphinae); sometimes they arise nearer to the anterior edge, are dorsal in position, and represented by microsetae (Tyroglyphus, Forcellinia). Sometimes they are lateral in position, external to the anterior angles of the propodosomal shield and almost in the same transverse line as v i: . in the latter case they are of considerable length, pectinate and enfold the gnathosoma (Tyrophagus, Tyrolichus) or project anteriorly (Aleuroglyphus, Kuzinia); in many Rhizoglyphini, v e are completely absent. (3) The external scapulars - sc e - arise behind the propodosomal shield, a short distance away from the posterior edge of the propodosoma; their position is very constant in all species and they are represented by macrosetae. (4) The internal scapulars - sc i - are internal to sc e and form with them a straight or arched transverse row (depending on whether they are placed on the same line as sc e, in front or behind it); they are very variable in length, and are not infrequently absent (in most Rhizoglyphini). On the hysterosoma, the following pairs of setae are placed. (5) External humerals - h e - are well developed in all representatives of the family and arise



Figs. 80 - 89

Figs. 80 - 85. Position of vertical setae in different Tyroglyphidae. Fig. 80 - Aleuroglyphus ovatus Tr: ve - external vertical setae; vi - internal vertical setae. Fig. 81 - Kuzinia laevis Duj., protonymph. Fig. 82 - Forcellinia fungivora Ouds. Fig. 83 - Tyrophagus perniciosus, sp. n. Fig. 84 - Tyrolichus casei Ouds. Fig. 85 - Acotyledon sp. Fig. 86 - Tyrophagus tenuiclavus, sp. n ♂ , tibia and tarsus IV: dc - tarsal copulatory suckers; ab, cd, ef - separate sections of the tarsus. Fig. 87 - Distal part of leg IV (genu, tibia and tarsus) of Rhizoglyphus echinopus F. and R, ♂ . Fig. 88 - Anal slit; copulatory suckers and setae of Tyroglyphus farinae L ♂ . Fig. 89 - Ditto of Tyrophagus humerosus Ouds.

laterally at the anterior angles of the hysterosoma. (6) The internal humerals - h i - are, as their name indicates, internal to h e but more dorsal in position, their length is very variable, but in most cases they are shorter than h e and in most Rhizoglyphini are completely absent. (7 to 10) Four pairs of dorsal setae (d_1 to d_4) form two longitudinal rows down the mid-line of the body, d_1 are much wider apart than the d_2 which succeed them; d_3 are almost the same distance apart as d_1, whilst d_4 are closer together. The distance between the separate pairs of dorsal setae, measured longitudinally, varies to a certain extent, in proportion to the size of the body and the degree of elasticity of the dorsal cuticle (which varies according to the degree of turgidity attained by the species, or its inflation during pregnancy); in males of the genus Schwiebia, d_4 are often greatly displaced laterally. The length of the posterior setae varies greatly, but as a rule they increase in length from front backwards and d_1 are shorter than any of the others; in Rhizoglyphini d_1, d_2 and sometimes d_3 are strongly reduced (Rhizoglyphus) or absent (in other genera). (11) The anterior laterals - l a - which are placed external and posterior to d_2, near the lateral edge of the hysterosoma, are usually short and sometimes absent. (12) The posterior lateral - l p - is more lateral and posterior than l a, usually on a level with a point midway between d_3 and d_4; they are found in all species and are sometimes very long. (13) The external sacrals - sa e - are placed on the side of the posterior corners of the body (sometimes they are more or less displaced ventrally). Finally, (14) the internal sacrals - sa i - are terminally placed on the posterior edge of the hysterosoma; these are present in all representatives of the family and are one of the longest pairs. The setae of the ventral surface of the body consist of a pair of subhumeral setae (sh), a constant assortment of coxal and genital setae and an anal complex, the number and distribution of which differs in the two sexes.

The coxal-sternal skeleton is very well-developed; epimera I are always joined to form a strong V-shaped sternum (st); all the others are free, (ep II to IV), with wide, plate-shaped apodemes projecting

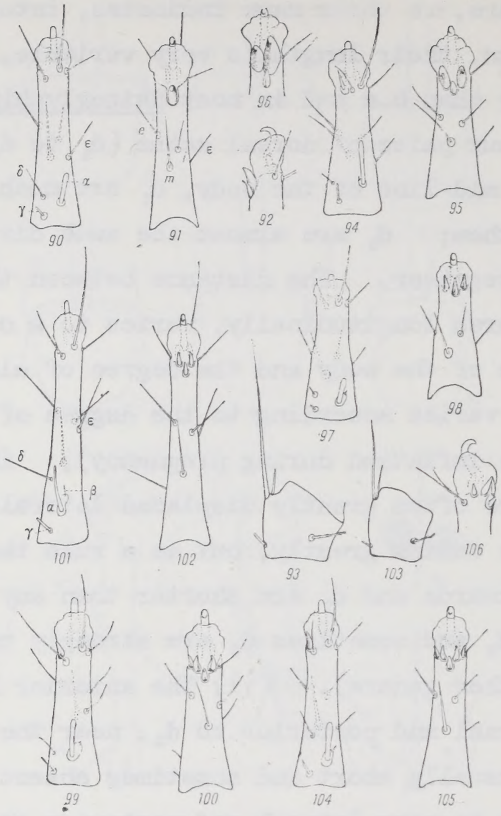


Fig. 90 - 106

Fig. 90 - Tyroglyphus farinae L, tarsus I, ♀, dorsal surface. Fig. 91 - Ditto, ventral surface. Fig. 92 - T. farinae L, end of tarsus I, ♂, lateral surface. Fig. 93 - T. farinae L, genu I, ♀. Fig. 94 - Aleuroglyphus ovatus Tr, tarsus I, ♀, dorsal surface. Fig. 95 - Ditto, ventral surface. Fig. 96 - A. ovatus Tr., end of tarsus I, ♂, ventral surface. Fig. 97 - Kuzinia laevis Duj., protonymph, tarsus I, dorsal surface. Fig. 98 - Ditto, ventral surface. Fig. 99 - Tyrolichus casei Ouds., tarsus I, ♀, dorsal surface. Fig. 100 - Ditto, ventral surface. Fig. 101 - Tyrophagus tenuiclavus, sp. n., tarsus I, ♂, dorsal surface. Fig. 102 - Ditto, ventral surface. Fig. 103 - T. tenuiclavus, sp. n., genu I. Fig. 104 - Forcellinia fungivora Ouds., tarsus I, ♀, dorsal surface. Fig. 105 - Ditto, ventral surface. Fig. 106 - F. fungivora Ouds., end of tarsus I, ♂.

inside the body (only in Schwiebia rossica are epimeres III and IV joined at their internal ends); epimerites II (ept II) are usually completely separate from other parts of the coxal-sternal skeleton and resemble narrow linear sclerites, placed transversely midway between propodosoma and hysterosoma, and thus accentuating this division.

The length and proportion of the legs is very variable, but their structure is uniform (escept in the heteromorphic ♂). The basal segments of the legs are more or less cylindrical, the tarsus usually narrowing slightly towards the end. The claws are sessile, of medium size or large, they are connected to the end of the tarsus by special sclerites (art) and are surrounded by a wide fleshy praetarsus (pr); in the majority of the Rhizoglyphinae the praetarsi are reduced and only envelop the base of the largest of the claws. The chaetotaxy of the four basal segments of the legs comprises an assortment of setae that is typical of this group: some of these setae may take the form of spines, but they are never pectinate or comblike; the ventral setae of the trochanter and femur are always smooth and the basal setae of the genu never reach a considerable length. The chaetotaxy of tarsus I (figs. 90 to 106, 202 to 224) which is of great systematic importance, consists as a rule of the following elements - a main sensory rod (alpha) - usually more or less club-shaped; at the base of alpha and on the same projection, a thin spine - beta - present in all genera. except Tyroglyphus; a basal rod - gamma - placed external and posterior to alpha; a seta - delta - anterior to gamma, at the same level as alpha or noticeably more distal; the conical seta - eta - arising on the internal surface of the tarsus, anterior and internal to alpha or immediately in front of it; four dorsal apical setae, of which the external one is often converted into a spine (sometimes reduced); three large ventral setae, very variable in structure and usually placed in the middle of the tarsus; of these one is medial and near the base, whilst the others are more lateral in position; five small ventral apical spines, sometimes of considerable size, but often partially reduced, so that there remain three (Tyrophagus) and even one (Tyroglyphus). In the Rhizoglyphini

there are considerable deviations from this scheme and many of the elements of tarsus I, e.g. sensillae eta, delta and sometimes one of the ventral spines, are absent. Tarsi III and IV have three apical setae dorsally and often one spine, two medial setae ventrally, and three to five (in Tyroglyphus - one) apical spines.

♂. The genital opening is placed between the bases of legs III and IV or between legs IV or behind their bases; the penis has a tubular distal part (stiletto) with a usually complicated, massive base; there are no structurally separate sclerites surrounding the penis and an epiandrium is absent. The genital "suckers" are always well-developed and finger-shaped, with a cylindrical or conical basal part clearly separated from a semi-spherical apical dome. The anal opening is more or less considerably displaced from the posterior edge of the hysterosoma, and lies close to the genital opening; lying on either side of its posterior end, and in most species, is a pair of fairly large, anal copulatory suckers (d c), the structure of which is fairly variable. In some forms (Tyroglyphus, many Rhizoglyphini), they take the form of a chitinised ring surrounded by an edge of very fine and elastic cuticle and, when erect, they are cylindrical in shape. In others, the anal copulatory suckers are represented by semi-spherical, weakly defined, non-chitinous cushions, and in erection only increase their rotundity; in such cases they have a well-developed endoskeleton consisting of a connecting sclerite, shaped like a bracket, which encircles posteriorly the edges of the suckers and anal slit. In the genus Histiogaster, the anal suckers are completely chitinised and have a characteristic structure. Only one pair of anal setae is usually present (in Scatoglyphus - two pairs), a second pair being converted into the anal suckers; in most species these arise from the raised parts of the anal suckers, in Tyroglyphus only - anterior to the central pore, in Aleuroglyphus siculus at a considerable distance in front of the suckers. In the genus Scatoglyphus, anal suckers are absent. Behind the anal slit are three pairs of post anal setae (p_1 to p_3), whose lengths and positions

are variable, in the genus Histiogaster there is only one pair (p_1), the other two pairs taking the shape of leaflike transparent lobes on the periphery of the opisthosomal plate. On the internal surface of tarsus IV there is a pair of tarsal copulatory suckers, more or less saucer-shaped and variable in position.

♀. The genital opening is always between epimeres III and IV, and is relatively small; there is no epigynium, nor chitinised circumgenital ring. The folds of the genital opening are always well-developed, with more or less thickened edges which meet for a considerable distance and then diverge in an arc outwards and backwards (often forming a fairly sharp obtuse angle at the point from which they begin to diverge). The genital "suckers" are well-developed, fingerlike, and similar in structure to those of the ♂. The opening of the bursa copulatrix is easily seen, but does not project from the surface of the body; in many species the skin surrounding it is slightly thickened. The anal slit is always separated from the genital by a fairly long distance; it is often displaced from the posterior edge of the body and is then about midway between the posterior edge and the genital opening (in most Acotyledonini). In most cases there are 7 pairs of circumanal setae; of these three pairs (anals) are microsetae and are distributed along the entire edge of the anus; the three pairs of adanals are larger and encircle the anals, and the remaining pair is formed by the adanals (often macrosetae and very long). In the Rhizoglyphini, the anal complex is reduced to one or two pairs of setae.

Secondary sexual differences between ♂ and ♀ Tyroglyphidae are numerous and marked, particularly in the subfamily Rhizoglyphinae (more especially in the Rhizoglyphini), where there occurs a clearly marked dimorphism in the males; these are represented by homeomorphic and heteromorphic phases, the homeomorphic being structurally similar to the ♀, the heteromorphic having a marked thickening of leg III and hypertrophic development of the secondary sexual characters.

The nymphal stages, on the whole, strongly resemble the adults and,

in addition to the usual differences due to age, differ from them only in some details of chaetotaxy and setal length (as in nymphs of the genus Tyrophagus) or in the position of v e (as in Aleuroglyphus and Tyrolichus). The larvae have well-developed rod-like "brust-stiele" (these are like buttons only in Tyrophagus) which have more or less clearly defined apical domes, similar in structure to the genital "suckers" found in nymphs and adults.

The hypopus (figs. 57 to 59) is entomophilic in type, serving as a means of distribution. The gnathosoma (gn), always well-developed, is movably connected with the idiosoma by a soft segmented membrane, and evidently functions as a sensory organ; it often consists of a longer basal segment, varying considerably in shape and proportion, and a pair of distal segments, each terminating in a strong, bristle-like arist (ar). In some forms the gnathosoma is not segmented and, in such cases, its end is usually more or less deeply cleft. In addition to the arists, there are two pairs of small setae, one on the dorsal surface of the distal segments, the other on the lateral surface of the basal.

The idiosoma is completely covered with a rather densely sclerotised plating, this is particularly hard on the dorsal surface, elliptical or egglike in shape, with a broad, rounded, posterior edge. The dorsal surface is strongly convex, the ventral one flattened and capable of being moved up and down by strong muscles. The edges of the idiosoma are usually flattened.

The propodosoma (pr) is always clearly separated from the hysterosoma, but is movably joined to it and capable of bending upwards (at an obtuse angle to the ventral surface of the hysterosoma); during these movements the posterior part of the dorsal shield disappears under the overlapping anterior edge of the hysterosoma, with which it forms a hinge at the sides. The shape of the propodosomal shield varies considerably, but in most species it is almost triangular. The rostral protrusion is well-developed, but sometimes (e.g. Robinisca, Froriepia and Viedebanttia) is completely absent, and the shield then has an arc-

shaped anterior edge; it is variable in size.

The lateral edges of the hysterosomal shields are bent on to the ventral surface in the form of a wide epipleuron, which evidently plays a certain part in fixing the hypopus to the transporter (by constituting the outer edge of that sucker formed by the body of the hypopus itself).

The surface of the dorsal shields is, in most cases, smooth (finely pored), sometimes it is covered with widely distributed depressions, but without a reticulate design or longitudinal or concentric markings; only a very narrow section along the anterior edge of the hysterosomal shield is covered with fine transverse lines; (according to Oudemans, this section may be of a membranous consistency).

All the setae of the dorsal surface are of the same type: thin microsetae, often difficult to see; they only reach a considerable size in certain genera (Tyroglyphus, Lackerbaüeria), where they resemble hairs; sometimes the scapulars are stronger than the rest and more or less bent (some Actoyledon sp.). The distribution of the setae varies to a certain extent, but owing to the difficulty of seeing them, this is little used in systematics. The pseudostigmatic organs are often well-developed and bristle-like. Eyes are usually absent, only in Monieziella are they well-developed and represented by semi-spherical lenses placed on the sides of the propodosoma (above the bases of leg I) and supplied with darkly pigmented retinae; in Histiogaster definitive lenses are absent and retinae are only present as a pair of optic spots placed close together at the end of the rostral protrusion.

The lower surface of the idiosoma is usually thickened, forming a series of sclerotised shields: the sternal - formed by coxal fields I and II, the ventral - formed by the fields of legs III and IV, and the genital - placed behind the ventral and often merging into one whole structure; the pleural fields, which encircle these shields from the sides, are also usually sclerotised to a varying degree. The structure of the sternal shield varies considerably; in some species epimeres II are free and do not reach the posterior edge, the shield then forms an undivided whole and coxal fields I and II remain open; in others,

epimeres II extend to the posterior edge and are there joined to epimerites II by a thin line, coxal fields II are thereby closed and appear as more or less rectangular lateral paired shields, separated from a non-paired triangular central one formed by coxal fields I; these are usually open (if the sternum does not reach their posterior edges), but are sometimes closed (in Forcellinia); in Froriepia the sternum merges with the ends of epimeres II and III. The lateral edges of the sternal shield (outlined by the more or less distinct epimerites II) often form clearly defined lateral corners with the posterior edge, so that the shield is trapezoid in outline; in other forms, however, the lateral corners are rounded or not marked at all and the shield is outlined posteriorly by an arched line.

In most cases the ventral shield is separated from the sternal by transverse soft flat membranous skin, but in the genus Histiogaster it is not separated at all, and forms a non-segmented whole; in Froriepia and Tyroglyphus it is separated only by epimeres III. The anterior edge of the ventral shield is formed by epimeres III and is parallel to the posterior edge of the sternal shield. In those cases where coxal fields III are closed and more or less widely separated (e.g. in Schulzea), the ventral shield is interrupted in the midline and itself divides the sternal into separate parts, i.e. into paired coxal fields III and IV. The ventral seam - a longitudinal membranous line - is usually present along the ventral shield, dividing coxal fields III and IV medially for a more or less considerable distance. Epimeres IV usually run diagonally and often reach the ventral seam with their ends, thereby closing coxal fields III and IV.

The genital shield is much longer than its width and is separated from the ventral by a straight or arched transverse line, this may be indistinct or even absent. The coxal setae are nearly always replaced by suckers which occupy corresponding positions on coxal fields I and III; one pair of genital setae arises where epimeres IV meet the ventral seam, and two others are found on either side of the genital slit; of these the external one is converted into a genital "sucker" (dg),

whilst the internal one remains unchanged. The genital slit is usually well-defined, with a pair of fingerlike genital "suckers"; in some species it is difficult to see, but in species of Acotyledon it merges with the anal to form a long ano-genital opening.

The sucking disc - da - is usually large, with 4 to 5 well-developed suckers and a well-chitinised surface surrounded by a ring of very elastic cuticle, which allows it to protrude above the surface of the body; it is not encircled by a membranous edge and there are no endoskeletal formations connected with it. Some species of Acotyledon (e.g. paradoxa, michaeli, rhizoglyphoides) have a reduced sucking disc, in extreme cases only represented by the rudiments of one or two pairs of suckers on an ill-defined non-sclerotised disc.

All four pairs of legs are well-developed, with slightly bent claws, but without any trace of membranous praetarsus; sometimes the claws are very long and, in Froriepia, they are almost bristle-like in shape. Legs I and II are always more strongly developed than III and IV; in most cases the last two pairs are almost completely hidden by the idiosoma, only the ends of the tarsi protruding beyond its edges. The setae arising from the four proximal joints of legs I and II are identical in number and distribution with those of the adult, differing only in the fact that the apex of genu I has only one dorsal seta (only Schulzea has two); the structure, size and shape of the setae is, however, very variable and they usually differ considerable from those found in adult and nymphal stages.

The chaetotaxy of tarsi I and II has the same elements as those found in the adult; the olfactory club is usually longer and more slender, gamma and delta, and often eta, have a rod-like shape; the external, internal, ventral and one or two of the apical setae are often flattened to resemble leaves, and the middle apical is nearly always widened distally to form an oval, saucer-shaped seta which has a sucking function. The number of setae present on tarsi III and IV is larger than in the adult; many of these setae are often leaflike in shape and one or two may attain a length equal to a half or four-fifths that of

the idiosoma (macrosetae). The hypopi vary in size from 150 to 475μ.

Key to the Subfamilies

1(2) Vertical external setae (v e) lateral in position, long and finely pectinate and arising near the anterior angles of the propodosomal shield, or represented by microsetae and slightly more posterior in position (at about a quarter the distance between the vertical internal and scapular setae); setae of the dorsal surface of the idiosoma usually long and thin, sparsely and finely pectinate; all the setae of the legs are fine and flexible, often barbed; claws fairly small, praetarsi well-developed, enfolding the greater part of the claw.

1. Subfamily Tyroglyphinae

2(1) Vertical external setae (v e) either represented by minute smooth microsetae, arising dorsally near the middle of the lateral edge of the propodosomal shield, or absent; setae of the dorsal surface of the idiosoma smooth, often stiff and swollen at the base, usually fairly or very short; sc i, h i, d_1, d_2 (and sometimes d_3 and l a) often absent; leg setae more or less pointed or spine-shaped; claws stout (particularly those on the anterior legs), praetarsus poorly developed, only enveloping the base of the claw.

2. Subfamily Rhizoglyphinae

Key to the genera of hypopi

1(2) Claws extremely long and thin; on tarsus I they equal the entire leg in length and only differ in structure and length from the long setae of the tarsi; the sucking setae of tarsi I and II

are also very long; epimeres II united with the sternum at their ends.

24. Froriepia Vtz.

One species only, F. vimariensis Vtz. (Germany)

2(1) Claws normal in structure and length, always much shorter than the tarsi; the length of the sucking setae is not more than half that of legs I and II; epimeres not united with the sternum at their ends.

3(4) A pair of large hemispherical eyes is placed on the lateral edges of the propodosoma (above the base of legs I).

14. Monieziella Berl.

4(3) Eyes absent, or situated on top of the rostral protrusion and lacking convex corneae.

5(36) Sucking disc well-developed, more or less strongly sclerotised, provided with 4 to 5 pairs of well-developed suckers.

6(35) Sucking disc rounded or transversely elongated, not larger than wide; external suckers always situated anterior to the posterior ones; sucking setae of tarsi I and II enlarged distally.

7(8) Setae of propodosomal shield (sc) very long, fine, 15-20% of the total length of the idiosoma; tarsus IV with a very long seta (macroseta) exceeding half the length of the idiosoma, and a second shorter seta.

1. Tyroglyphus Latr.

8(7) Sc short, not exceeding 5-8% of the length of the idiosoma.

9(10) Gnathosoma trapezoid in shape, considerably shorter than its basal width; coxal fields III closed, wide apart; genital shield not separate from the ventral. On bumble bees and in their nests.

3. Kuzinia gen.n.

10(9) Gnathosoma shaped otherwise, considerably longer than wide at its base; when coxal fields III are very wide apart and shut, the genital shield is separated from the ventral by a well-defined transverse suture.

11(34) Apex of genu I with 1 seta only.

12(13) Epimeres III and IV free, not reaching the middle line of the body; sternal and ventral shields not separated from one another and the coxal fields, forming with them a wide undivided surface; rostral protrusion with a pair of eyes very close together and represented by a mass of dark pigment with feebly differentiated cornea, or else lacking eyes.

12. Histiogaster Berl.

13(12) Epimeres III joined or close together at their ends, thus outlining the anterior edge of the ventral shield; coxal fields III generally shut. Eyes absent.

14(27) Two pairs of coxal suckers well-developed, normal.

15(16) Tarsi IV bearing two long macrosetae, of which one nearly equals the body in length; dorsal shields covered with a coarse and densely pitted sculpturing. Coxal suckers situated on the surface of the much thickened coxae; external ventral seta of tibiae I and II, as well as the external basal of the genua (of the same legs) long, flexible, pectinate.

16. Lackerbalieria gen.n.

16(15) Tarsi IV devoid of long macrosetae; surface of the dorsal shield smooth (finely porose) or scantily pitted; thickenings of edges of coxal fields scarcely visible or else absent; basal seta of genua I and II, smooth, short and stout.

17(19) Sucking disc small, separated from the posterior edge of the body by a distance considerably exceeding its length; external edges of coxae I and II long, rectangular; tarsi III and IV long and thin, normally forming a right angle with the rest of the leg (air preparations).

8. Acotyledon Ouds.

18(17) Sucking disc larger; the distance between its posterior edge and the posterior edge of the body considerably smaller than its length; external edges of coxal fields III normally short, more or less convex; tarsi III and IV shorter and stouter.

19(20) Coxal fields II joined immediately behind the short sternum, so that only a very narrow longitudinal space is left between their internal borders; transverse diameter of the sucking disc nearly 1.5 times less than the width of the idiosoma; sucking setae of tarsi II represented by a very large leaflike appendage. A very small species. Length 155μ.

20. Rodionovia gen.n.

Only one species, R. inopinata Vtz. (Germany).

20(19) Coxal fields II not joined behind the sternum, separated by a large space which is often open; transverse diameter of sucking disc not exceeding half the width of the idiosoma. At least 200μ in length.

21(22) Sternum and epimeres II reaching the posterior edge of the sternal shield, thus separating and closing coxal fields I and II; external suckers placed in front of the central.

6. Forcellinia Ouds.

22(21) Sternum not reaching the posterior edge of the ventral shield, thus leaving coxal fields I more or less widely open; external suckers of sucking disc placed at the same level as the central suckers.

23(24) Gnathosoma long and narrow, with parallel edges, not bifurcated terminally; anterior edge of the propodosomal shield arched, parallel with the anterior edge of the hysterosoma and not forming a rostral protrusion; v i absent; legs I completely visible from above.

17. Robinisca gen.n.

24(23) Gnathosoma different in shape; when narrow and elongated, the limbs of its fork form small, independent, cylindrical joints; propodosomal shield almost triangular, forming a distinct rostral protrusion; when its anterior edge is arched, the shield has a semicircular shape, projecting like a visor and almost entirely covering legs I and II; v i well-developed, but sometimes concealed by the ventral surface of the shield.

25(26) Sensilla eta of tarsi I and II and dorsal apical seta of genu I thickened and club-shaped, blunt or a bit swollen terminally; rostral protrusion densely pitted.

10. Rhizoglyphus Clap.

A single cosmopolitan species, R. echinopus F. and R.

26(25) Sensilla eta of legs I and II, as well as the dorsal apical seta of genu I shaped like a stiff seta, tapering towards its end; rostral protrusion not pitted.

9. Caloglyphus Berl.

27(14) Anterior coxal suckers completely reduced or replaced by setae; posterior ones normally developed, or else replaced by setae, or completely reduced.

28(31) Posterior coxal suckers well-developed and normal in structure.

29(30) Anterior coxal suckers replaced by setae; idiosoma very wide, almost round; propodosomal shield very short.

8. Acotyledon Ouds.

30(29) Anterior coxal suckers completely reduced; idiosoma elongated, 1.5 times longer than wide; length of the propodosomal shield equal to one quarter that of the hysterosomal.

13. Schwiebia Ouds.

31(28) Posterior coxal suckers replaced by setae or completely reduced.

32(33) Both pairs of suckers replaced by fairly long, stiff setae; coxal fields III and IV fairly wide apart; gnathosoma with the distal segment clearly separate.

9. Caloglyphus Berl.

33(32) Both pairs of coxal suckers replaced by indistinct microsetae, or the posterior ones are reduced; coxal fields III and IV joined along the median line of the body; gnathosoma not segmented, slightly bifurcated at the tip.

19. Troupeauia gen.n.

34(11) Apex of genu I with 2 dorsal setae; coxal fields II and III closed, widely separated, all with distinct lateral thickenings; external suckers of sucking disc appreciably in front of the central ones.

23. Schulzea gen.n.

35(6) Sucking disc considerably elongated, narrow, tongue-shaped; posterior and lateral suckers situated on the same level, very small; sucking setae of tarsi I and II narrow, not swollen distally.

8. Acotyledon Ouds.

36(5) Sucking disc completely reduced and of the same soft consistency as the surrounding fields, bearing only 2 pairs of reduced suckers, which are difficult to see.

8. Acotyledon Ouds.

The genera Viedebanttia Ouds., Sancassania Ouds., and Garsaultia Ouds., which are insufficiently described, have not been included in this key.

1. Subfamily Tyroglyphinae

V e arise laterally from the anterior angles of the propodosomal shield, on approximately the same transverse line as v i, or slightly posterior to them; in the first case they are fairly long, thin and thickly pectinate; in the second, they are more dorsal and posterior in position (but do not exceed one quarter of the distance between a line drawn through the base of v i and the scapular setae) and small (a quarter to an eighth of the length of v i), smooth or finely serrated. Sc i are longer than sc e or equal to them, seldom two or three times shorter. The setae of the dorsal surface of the idiosoma are generally long, thin, flexible and sparsely pectinate, never thickened at the base; their number (14 pairs) is extremely constant and never reduced. The setae of the dorsal half of the hysterosoma are usually very long, radiating from the back and sides to form a fan-shaped train.

As a rule the legs are fairly slender, more constant in length and proportions than in the subfamily Rhizoglyphinae and more feebly armed; all the setae of the tibia, genu and middle ventral region of the tarsus are thin, flexible, more or less serrated, or sometimes finely and sparsely feathered. The apex of the tarsus sometimes has a small, conical dorsal spine (in the genera Tyrolichus and Forcellinia) and one to five ventral spines; the longest of the apical setae of tarsi I and II is the second internal to the dorsal apical spine (or its rudiment), which is always hairlike. Beta is anterior in position to the sensory club, and is either well-developed (in Tyrophagini) or completely absent (Tyroglyphini); sensillae delta and eta are always well-developed; eta, in all species, being bristle-like and placed at a marked distance

anterior and internal to the sensory club. The claws are small, the praetarsus large and cushion-like, covering the larger half of the claws.

Sexual dimorphism is not great, except in the genus Tyroglyphus; in the ♂ the hysterosoma is never modified, neither does it differ in shape and proportions from that of the ♀. Heteromorphic males never occur in this group.

Three pairs of post-anal setae always occur in the ♂ and they are always long. Tarsal copulatory suckers are both placed in the proximal half of tarsus IV, or at an equal distance from the base and apex; the apical dorsal seta of tibia IV is of normal structure.

Three pairs of anal microsetae are found in the ♀, often fairly long; also three pairs of rather longer adanal setae and one pair of very long postanal setae. (The total number of elements in the anal complex is seven pairs in all species); the anal slit is usually displaced to the posterior edge of the hysterosoma.

Secondary sexual differences are very slight and consist only in a relatively longer length of setae of the idiosoma, and sometimes in individual differences in the chaetotaxy of the ventral side of the ends of the tarsi; only in the genus Tyroglyphus are these differences sharply marked.

In the nymphal stages, there is no retardation of the development of setae of the dorsal surface (e.g. v e, sc i, h i, d_1 to d_2, l a), but considerable displacement of v e is not uncommon during development (in such cases, v e is more posterior in the larva than in the adult, and gradually becomes more anterior in position). Only a few representatives of the subfamily form a hypopus (Kuzinia, Tyroglyphus and Forcellinia) and this is obviously correlated with the greater tendency for dispersal of other stages. (This is due to their mobility and to the power of dispersal by air) and with the marked polyphagy of most species.

The characters of the subfamily Tyroglyphinae correspond to those established by A.C. Oudemans for the Tyroglyphidae Ouds. 1932, Tyrophagidae Ouds. 1924, and Forcelliniidae Ouds. 1924, with the addition of some species from his family of Caloglyphidae (Aleuroglyphus ovatus Troup. 1879

and Mycetoglyphus (= Forcellinia) fungivora Ouds. 1932; it is also possible that the extra-palearctic family Ebertiidae Ouds. 1924 (genus Ebertia Ouds. 1924) should also be included here. According to me this family consists of 35 to 40 species, of which slightly more than 20 have been described from the palearctic region; they can be divided into 8 to 9 genera, forming the two tribes Tyroglyphini and Tyrophagini.

1. Subfamily Tyroglyphinea

Key to genera

Adults

1(2) Dorsal surface of legs I and II with a bifurcated or cruciform keel; all the setae of the dorsal surface thick, short and densely pectinate; ♂ lacking anal and tarsal copulatory suckers, with two pairs of anal microsetae; anal opening of the ♀ remote from the posterior end of the body.

7. Scatoglyphus Berl.

2(1) Joints of all legs smooth, without branching keels; body setae of different structure; ♂ with anal and tarsal suckers well-developed, with only one pair of anal microsetae; anal opening of ♀ close to posterior end of body.

3(4) Sexual dimorphism very pronounced: in the ♂ legs I are more or less thickened, the femur bears on the ventral surface a strong, conical spine; in the ♀ the legs are of normal structure; internal apical seta of genu I very long, 6-10 times longer than the external, which is shaped like a rod and blunt at the end; apex of tarsi with a single small ventral spine and with no dorsal spine; famulus absent (1. Tribe Tyroglyphini)

1. Tyroglyphus Latr.

4(3) Secondary sexual characters little developed; legs I normal in both sexes; internal apical seta of genu I not more than three times longer than the external, which normally is setiform; ends of tarsi with 3 to 5 small ventral spines and often, one dorsal; famulus present (2. Tribe Tyrophagini).

5(8) Ends of tarsi with fairly stout dorsal spine and 5 ventral spines.

6(7) V e very long (nearly three-fifths the length of v i), finely and densely pectinate, lateral in position, a little posterior to the level of the base of v i; they enfold the gnathosoma and are distinctly curved, and their ends are directed obliquely internally and ventrally; pseudostigmatic organ lanceolate, very plumose; sensilla eta situated at the same level as the olfactory club; in the ♂ the tarsal copulatory suckers are placed approximately at the same distance from the base and apex of tarsus IV.

4. Tyrolichus Ouds.

7(6) V e represented by microsetae (4 to 6 times shorter than v i), smooth or feebly barbed, situated considerably posterior to the transverse level of v i; pseudostigmatic organ setiform; eta arises distal to the olfactory club; copulatory suckers of ♂ both situated in the basal half of tarsus IV.

6. Forcellinia Ouds.

8(5) Ends of tarsi with 3 ventral spines; v e resembling that of the genus Tyrolichus, long and pectinate.

9(10) L a very long, represented by macrosetae; d_2 placed nearly on the same transverse line as d_1, very long; tarsi I and II with a stout longitudinal keel.

3. Kuzinia, gen.n.

Only one species, K. laevis Duj. (= Hypopus laevis Duj. = Tyroglyphus fucorum Ouds. = T. lundbecki Träg.) living in bumble bee nests.

10(9) L a very short, equal to d_1 in length; d_2 considerably posterior to d_1; tarsi I and II without longitudinal keel.

11(12) Legs relatively short and stout; chelicerae very large; v e straight or feebly curved, sensilla eta placed at the same level as the sensory club.

2. Aleuroglyphus gen.n.

12(11) Legs relatively long and thin; chelicerae of normal dimensions; v e long, strongly curved ventrally and inwards; sensilla eta of tarsus I situated well distal to the sensory club.

5. Tyrophagus Ouds.

1. Tribe Tyroglyphini

Zachvatkin, 1937:179 - Tyroglyphidae; Oudemans, 1932, Entomol.Ber.VIII, no: 183:35.

Sexual dimorphism is well-defined: in the ♂ the legs are more or less strongly thickened and have a large, conical tooth on the ventral surface of the femur, and some small projections on the ventral surface of the genu. The chaetotaxy of the distal end of the tarsus consists of only one ventral spine, but in the ♂ tarsus I has directly behind this, and overlapping it, a scale-like spine broadened at its base, the sensilla beta (that seta found in front of the sensory club) is absent; the internal apical seta of genu I is very long, 6 to 10 times longer than the external one, which resembles a straight rod with a blunt end. The anal copulatory suckers of the ♂ are round, with a well-cuticularised, peripheral ring, encircled by very soft, pliable cuticle; when erect, they are a regular, cylindrical shape; well anterior to the suckers is the

anal pair of setae.

Only one genus containing 3 species is known.

1. Genus Tyroglyphus Latr.

Latreille, 1796, Précis d. caract. gener. d. Insectes: 185; Oudemans, 1924, Entomol. Ber., VI: 250. Aleurobius Canestrini 1888:7; 1888a:357; Berlese, 1898 XXXV, No: 12; Kramer, 1899:137; Michael, 1903:71.

Type species: Acarus farinae Linné 1758.

V e - 5 to 6 times shorter than v i - are smooth, straight microsetae, almost dorsal in position and placed considerably behind a line drawn through the bases of v i (at approximately a quarter to a fifth of the distance between this line and the scapular setae); Grandjean's organ is a complicated structure, consisting of several branched protrusions. Sc i are equal to sc e in length or are considerably shorter; h i are much shorter than h e; d_1, d_2 and l a are also short; the remaining setae differ in length in the various species. The legs are fairly long and slender, except for leg I in the ♂; the sensilla delta of tarsus I is placed in the proximal quarter of the tarsus, on the same level as the sensory rod.

♂. P_1 are external to p_2, almost marginal in position, forming with p_2 and p_3 an arc-shaped transverse line, running parallel to the posterior edge of the idiosoma; both tarsal copulatory suckers are in the proximal half of tarsus IV.

♀. The anal and adanal setae are both represented by microsetae, only the postanals being long. The position of v e in larvae and nymphs does not differ from that of the adult. In one species there is both a migratory and resting hypopial form.

Three species are known, of which one (T. africanus Ouds. 1910) requires a more detailed study.

1. Tribe Tyroglyphini

Tyroglyphus (Latr.) Ouds.

1(2) Sc i 2 or 3 times shorter than sc e; d_1, d_2 and l a represented by microsetae, all the other setae of the dorsal surface of the hysterosoma very long, distinctly pectinate, forming a fan-shaped tail similar to that of Tyrophagus; pseudostigmatic organ long, setiform, feebly pectinate; tarsus I of the ♂ with a projection arising from the middle of the ventral surface.

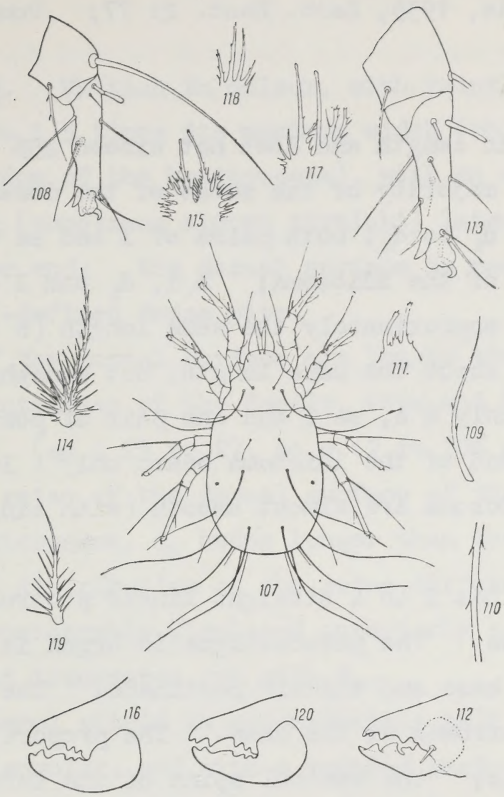
U.S.S.R. (Kazam, Ukraine) 2. T. tyrophagoides sp.n.

2(1) Sc i equal in length to sc e; except for h e, sa i, and one pair of postanals, all the setae of the hysterosoma are very short, almost smooth; the posterior edge of the body thus bears only two pairs of fairly long setae; the pseudostigmatic organ is short, produced into numerous pectinations and swollen at the base; tarsus I of the ♂ without a projection on its ventral surface.

1. Tyroglyphus farinae L.

1. Tyroglyphus farinae L. - the flour mite. (Figs. 2 and 3, 25 to 32, 57 to 59, 66 to 69, 90 to 93, 113 to 120.)

Linné, 1758, Syst. Nat. ed. X. vol. 1, pt. 2:616; C.L. Koch, 1841, Dtsch. Crust. XXXII, fig. 21, 22 (Acarus); Gervais, 1844, in: Walkenaer, Hist. Nat. Ins. Apt. III: 262; Berlese, 1884: XIV, No.9; Oudemans, 1923, Entomol. Ber., VI: 250 (Tyroglyphus); Canestrini, 1888: 26, t.II; 1888a: 399, t XXX, fig. 1; Michael, 1903: 73, t. XXXIX (Aleurobius) - siro Robin, 1860, Bull. Soc. Nat. Moscow, XXXIII: 184, t. VIII; Troupeau, 1878: 101 (Aleurobius) - farris Oudemans, 1905, Entomol. Ber., II, No. 26: 20 (Aleurobius); 1913, Arch. f. Naturg., 79, H.10: 45, t. XVII, fig. 19-23, u.t. XVIII, fig. 1-16 (Tyroglyphus).



Figs.107 - 120

Fig.107 - Tyroglyphus tyrophagoides, sp.n., ♀, dorsal surface. Fig.108 - T. tyrophagoides, sp.n. leg I (tibia and tarsus), ♂ , lateral surface. Fig.109 - T. tyrophagoides, sp.n., pseudostigmatic organ. Fig.110 - T. tyrophagoides, sp.n. section of one of the longer hysterosomal setae. Fig.111 - T. tyrophagoides, sp.n., Grandjean's organ. Fig.112 - T. tyrophagoides, sp.n., chelicera, internal surface. Fig.113 - T. farinae L. f. typica, leg I, (tibia and tarsus), ♂ . Fig.114 - T. farinae L.f. typica, pseudostigmatic organ. Fig.115 - T. farinae L.f. typica, Grandjean's organ. Fig.116 - T. farinae L.f. typica, chelicera. Figs.117, 118 - T. farinae L.f. farris, different shapes of Grandjean's organ. Fig.119 - T. farinae L.f. farris Ouds, pseudostigmatic organ. Fig.120 - T. farinae f. farris Ouds, chelicera.

Biology, detrimental effect, Michael, 1903: 78-79; Maurizio, 1905, 1906; Newstead and Duvall, 1921; Zacher, 1927, 1933; Romanova and Ilijinskaia, 1935, Zach. Rast. 2: 77; Romanova, 1936, Zach. Rast. 8: 20.

Sc i equals sc e in length and does not exceed 25% of the length of the idiosoma; the majority of the setae of the dorsal surface of the hysterosoma - h i, d_1 to d_4, both pairs of l and sa e - are short, 6 to 20% of the length of the idiosoma; h i, d_1 and l a are shorter than the others and of approximately the same length (6 to 12%); d_2 to d_4 and l p are also about the same length, but somewhat longer than the preceding ones; only h e, sa i and one pair of postanals are long, so that the posterior end of the idiosoma bears only 4 long setae; all the setae of the hysterosoma are almost smooth (with single, widely spaced pectinations).

Grandjean's organ has 2 to 4 straight linear protrusions, with a very finely divided base. The pseudostigmatic organ is fairly short, usually swollen at the base and thickly pectinate. The genital suckers are slightly narrowed at the base. The proportions of the legs are fairly variable; the ventral spine of the tarsus is usually fairly large.

♂. Tarsus I is more or less considerably widened towards the base on the ventral surface; tibia I is conically truncate; p_1 scarcely shorter than p_2, not more than one-third the length of p_3. The anal setae are not thickened. Length 320-430μ.

♀. Tarsus I not more than 4 times greater than tarsus IV, and up to 6 times longer than its diameter at the middle. The ventral setae of tarsus IV are at a distance from each other, one is further from its end of the joint than the other. Length 350-670μ.

Larva. All the setae of the dorsal surface of the idiosoma (including sc) are microsetae; the postanals are longer than the others, but they

do not exceed 25% of the idiosoma in length. The "bruststiele" are slender, very slightly thickened distally, with feebly developed apical domes.

Migratory hypopus. Whitish in colour, with faintly pink legs. The idiosoma is 1.3 to 1.5 times its maximum width (which is at the level of the anterior edge of the hysterosoma), with an obtuse anterior edge, feebly protruding (sometimes almost straight) lateral edges and a semicircular posterior end; the dorsal surface is moderately arched and covered with well-defined dense pits.

The setae of the dorsal surface are longer than in the hypopi of all other representatives of the family, thin and hairlike, sc being particularly long, (sc i 25 to 27, sc e 12 to 20% of the length of the idiosoma); the setae of the dorsal surface of the hysterosoma are 5 to 10% of the hysterosoma, d_3 being longer than the others; sc i are very short. The distribution of the setae differs from the normal, in that d_2 are considerably displaced anteriorly and d_1 are lateral, forming a straight transverse row with d_2.

The propodosomal shield is approximately half the length of the hysterosomal, triangular, and with a rounded rostral protrusion; this is separated by slightly sloping folds from the feebly arched anterior lateral edges of the shield; v i are fairly long. Eyes are absent. The gnathosoma is 1.5 times longer than its breadth, with very short, feebly separated distal segments, and is completely hidden under the rostral protrusion. The sternal shield is well-defined laterally by strong epimerites II, which unite at their ends with epimeres III; the sternum and epimeres II are free. Coxal fields III are half open and epimeres IV have angular ends bending anteriorly. The genital shield is indistinctly separated from the ventral. The ventral seam is only noticeable in the region of coxal fields IV and edge thickenings are fairly well-developed. Coxal suckers are absent (rudimentary coxal setae are present) and the genital ones are placed nearer to the external edges of the shield than to the genital slit.

The sucking disc is small and transversely elliptical in shape, its peripheral suckers are slightly smaller than the central and lateral ones, and with the latter form a straight transverse row; the auxiliary suckers are poorly developed. The distance between the posterior end of the sucking plate and the posterior end of the body is equal to the length of the disc.

Legs I and II are of medium length (30 to 35% of the idiosoma), moderately thick and almost completely visible from above; the ventral setae of the femur are very long, whilst the ventro-lateral ones of the tibia and genu are thin, smooth, and fairly short. Genu I has one (short) apical seta. The tarsus is approximately 3 times longer than its diameter at the base, not longer than tibia and genu taken together; its sensory rod is very long and thin, sharply curved before ending in an expanded tip; gamma and eta are like setae; the middle internal seta is pectinate, whilst both lateral and two of the apical ones are narrowly lanceolate. Leg III is almost 25% of leg IV in length and about 20% of the length of the idiosoma, the ventral setae of its tibia are long and the tarsus has 4 lancet-shaped and some fairly long simple setae. Tarsus IV terminates in a long macroseta. Length 200 to 260μ, width 140 to 180μ.

The Resting Hypopus. The idiosoma is widely elliptical, with a semi-circular anterior edge, devoid of rostral protrusion; the dorsal surface is fairly arched, smooth, with very short thin, scarcely perceptible setae (certain of them are evidently vestigial). The gnathosoma is considerably reduced and represented by a pair of blunt processes, but no arists. The structure of the coxal-sternal skeleton is, on the whole, similar to that of the migratory hypopus. The sucking disc is rudimentary, barely discernible, with three pairs of reduced and evidently non-functional suckers. External peripheral and genital suckers are completely basent. The legs are short and stumpy; of legs I, only the tibia and tarsus protrude beyond the edges of the body, of legs II, only the tarsus, and legs III and IV are completely concealed beneath the

idiosoma. All the setae are minute, leaf-shaped, and macrosetae are absent. The sensory rod resembles that of the migratory form. Length 200μ, width 160μ.

Habitat. Cosmopolitan, a synantropic species. It had been found in the fields of Germany, Holland, and in many parts of the forest and steppe regions of U.S.S.R.

Ecology. T. farinae is one of the most voracious species of granary mites, living on the most varied products of plant and animal origin, in hay, straw and plant remains; it is particularly associated with the continual destruction of grain and its products. In comparison with other granary species, it is characterised by a high ecological valency and greater resistance to changes in temperature and humidity; its optimum temperature is 22 to 25°C. and its optimum relative humidity is 80 to 90% (this corresponds to a 16 to 17% moisture content of grain and 17 to 18% of flour), but it will develop well at 7 to 8°C., and at a relative humidity of 70%. In field conditions, it is more widely distributed than other granary species, and is frequently found in the nests of mouse-like rodents, field mice and voles. The hypopi are carried by the most varied insects, depending on the nature of the habitat and its insect fauna: bumble bees - Osmoderma eremita Scop., Staphylinids and other inhabitants of dead plant residues, fleas, Ceratophyllus tesquorum Wagn, Ctenphthalamus breviatus Wagn and Joff., C. teres J. and Arg., Neopsylla setosa Wagn, Pulex irritans L., Hystrichopsylla segnis Schönch, etc.; small mammals and birds also serve as transporters of hypopi.

Variation in T. farinae is very great and affects a large number of characters: the degree of thickening of leg I in the ♂, the intensity of colour of the appendages, the relative length of the setae of the idiosoma, the structure of the pseudostigmatic organ, the protrusions of Grandjean's organ, chelicerae etc. In certain populations (particularly those of the wild species) individuals prevail with pale, hardly pigmented appendages, scarcely thickened legs I of the ♂, a weakly

feathered pseudostigmatic organ and relatively long setae on the idiosoma. Such individuals have been described by Oudemans as a separate species - T. farris Ouds. These forms have, however, no taxonomic significance, as intermediate forms exist and all these characters are variable.

2. Tyroglyphus tyrophagoides sp. n. (figs. 107 to 115).

A small species, which in general appearance superficially resembles species of the genus Tyrophagus, the resemblance being particularly great in the females. Sc i 1.8 to 3.2 times shorter than sc e, whose length equals 50 to 60% of the idiosoma. Among the setae arising from the dorsal surface of the hysterosoma, the only short ones (i.e. 4 to 13% of the length of the idiosoma) are h i, d_1, d_2, and l a, all the others vary from 40 to 75% of the length of the idiosoma and are finely but distinctly pectinate (this is particularly noticeable in the proximal 2/3 of their length), they resemble those of the genus Tyrophagus and form a similar, full, fan-shaped tail. Grandjean's organ is represented by two linear protrusions, of which the most distal one is sharply bent ventrally, it bears several fine serrations along its length. The pseudostigmatic organ is long and bristle-like, slightly curved in the basal third, and very feebly pectinate. The genital "suckers" are cone-shaped and sharply narrowed towards the base.

♂. Tarsus I is almost cylindrical, with a ventral protrusion near the middle of the joint. The macrosetae of the body are more thickly pectinate than in the ♀; p_1 is a quarter the length of p_3 and a half the length of p_2. The anal setae are spine-like. Length 290μ.

♀. Tarsus I 6 times, and tarsus IV approximately 8 times, longer than its diameter at the middle. Length 390 to 430 μ.

Distribution. It has been described from 1 ♂ and 1 ♀ from Agrizsk in the Tartar A.S.S.R., and 2 females from the Nerubaev Forestry region near Odessa.

Ecology. The specimens from the Tartar region were found in the surface layer of the soil (which was evidently mixed with plant remains) near a government seed store; those from the Odessa region were collected from the dead leaf litter in a deciduous forest.

In the Tartar ♀ the setae of the idiosoma were noticeably shorter than in the one from the Ukraine, the lengths of d_1 and d_2 being 4 to 5, of l a 8, sc i 17, d_4 and sc e 47% of the length of the idiosoma, whereas in the Ukraine specimen d_1 and d_2 were 9 to 12, l a 11 to 12, sc i 25 to 33, sc e 55 to 57, and d_4 62 to 73% of the length of the idiosoma; here also the pseudostigmatic organ is much longer, and possibly two different subspecies are under consideration, but the material available is not sufficient to decide this question.

2. Tribe Tyrophagini

Zachvatkin, 1937: 179; Tyrophagidae + Forcelliniidae Oudemans, 1923, 1927.

Sexual dimorphism is practically absent; legs I of the ♂ are unmodified. The chaetotaxy of the end of the tarsus consists of 3 to 5 ventral and often of 1 dorsal spine; sensilla beta is always well-developed; the internal apical seta of genu I is slightly longer than the external. The anal copulatory suckers of the ♂ are rounded or egg-shaped and surrounded by an incomplete, less conspicuous membranous ring; when erected, they are more or less semi-spherical (they are absent in the genus Scatoglyphus); the anal pair of setae is nearly always close to the suckers, usually arising from their rounded protrusions.

In the Palearctic region, this tribe is represented by 6 genera, with approximately 20 species; in other regions is found the genus Povelsenia Ouds. 1924, and possibly the genera Ceroglyphus Vitzthum 1919 and Ebertia Ouds. 1924 should also be included here. In addition, many species now placed in the N. American "genus" - Tyroglyphus - T.americanus Banks 1906, T. lintneri Osb., T. breviceps Banks 1906, T.coccophilus Banks 1906, undoubtedly belong here.

2. Genus Aleuroglyphus, gen.n.

Zachvatkin, 1935: 24 (nom. nudum)

Type species: Tyroglyphus ovatus Troup., 1879

The chelicerae are very large and massive, especially in the ♂, they are one-third to one-quarter the length of the idiosoma. V e are lateral in position, almost on the same transverse line as v i, they are 1.5 times shorter than v i, straight, feebly serrated or thinly pectinate; the lengths of the setae differ in the different species, but some are represented by macrosetae; their degree of pectination also varies, but they are never thickly pectinate. The pseudostigmatic organ is thickly barbed. The legs are short and thick, with 3 ventral spines at the ends of the tarsi, but no dorsal one (it is represented by a short, thickish seta).

♂. P_2 form with p_1 an arched row, which is dented anteriorly and is placed at a considerable distance from the posterior edge of the idiosoma; p_3 are almost marginal in position. The tarsal copulatory suckers are placed at approximately equal distances from the base and apex of tarsus IV.

The two species which are included in the genus Aleuroglyphus have only been found in Europe.

2. Tribe Tyrophagini

Aleuroglyphus gen. n.

1(2) Sc i 2 to 2.5 times shorter than sc e; h i, all the ds and both pairs of l (l a and l p) are represented by very short setae, finely pectinate; h e, sa e, sa i and one or two pairs of postanals are the only setae which are fairly long; together they form (with the exception of h e) a thin and short "train"; anal micro-

setae of the ♂ arising from the convex surface of the anal suckers - Holland, U.S.S.R., France. 1. A. ovatus Tr.

2(1) The two pairs of sc are of equal length; the majority of the setae of the hysterosoma (h e, h i, d_3, d_4, l p and two pairs of sa and one pair of postanals) are very long (measuring 40 to 100% of the length of the idiosoma), forming together a fine, fan-shaped "train"; anal microsetae of the ♂ a considerable distance from the anal suckers - Sicily, U.S.S.R., (Armenia).

2. A. siculus Fum. and Rob.

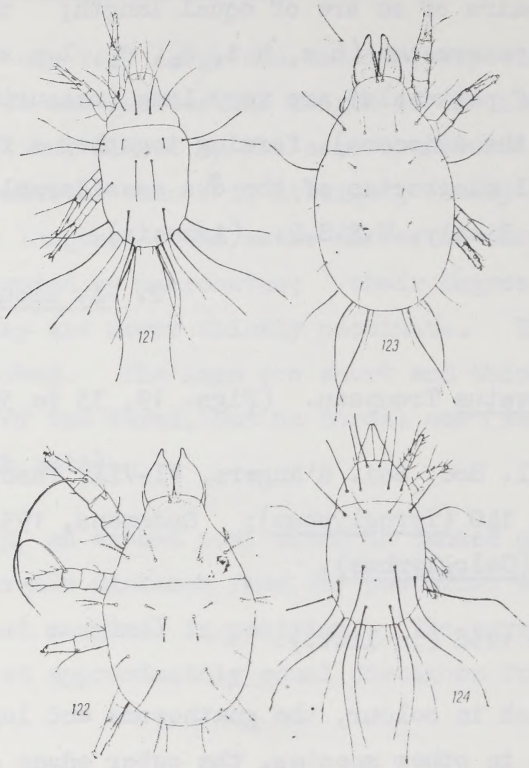
1. Aleuroglyphus ovatus Troupeau. (Figs. 19, 33 to 35, 80, 94 to 96, 122)

Troupeau, 1878, Bull. Soc. Sci. d'Angers, VI-VII, fasc. 11:105, fig. 9 to 11; Kramer, 1899: 140 (Tyroglyphus); Oudemans, 1932, Entomol. Ber. VIII, No. 183, 358 (Caloglyphus).

Ecology - Nastukova 1938 (in litt.).

Idiosoma whitish in colour, the gnathosoma and legs a deep red wine colour, darker than in other species, the outer edges of the chelicerae are very convex.

V e 1.5 to 2 times shorter than v i, very finely pectinate; sc i 2 to 2.5 times shorter than sc e, which are 22 to 25% of the length of the idiosoma; h i, d_1 to d_3 and l a very short (4 to 7% of the length of the idiosoma), sparsely feathered and usually bifurcate and somewhat twisted at the end, l p are similar in structure, but somewhat longer (9 to 10%), as are d_4 which exceed them in length (13 to 15% of the idiosoma). Among the setae of the hysterosoma, only h e (20 to 27%), sa e (23 to 24%, sa i (40 to 58%) are macrosetae; in addition, there are two pairs of postanals, and the four last-named pairs together form a thin, short "tail" of finely and sparsely pectinate setae. The pseudostigmatic organ is large, flattened, widely lance-shaped, with a fringe



Figs.121 - 124

Fig.121 - Tyrophagus noxius A.Z. ♀. Fig.122 - Kuzinia laevis Duj., protonymph. Fig.123 - Aleuroglyphus ovatus Troup, ♂ . Fig.124 - Aleuroglyphus siculus F and R. ♀.

of numerous (about 20) needle-shaped protrusions.

Tarsus I is 2.2 to 2.7, tarsus IV 2.5 to 3 times longer than their diameter at the base, almost cylindrical; both latero-ventral setae of the tarsus are hook-shaped, curved and enlarged, particularly on legs I and II; the apical dorsal seta of tibia IV is shorter than the tarsus.

♂. P_1 3 times longer than p_2, p_3 twice as long as p_2, p_3 being about 40% of the idiosoma in length; the penis is almost straight, gradually tapering towards its end, almost 3 times longer than its width at the base; the anal setae are placed on the raised part of the egg-shaped, anteriorly ill-defined, anal copulatory suckers; both latero-ventral apical setae of tarsi I and II are considerably thickened (larger than in the ♀), the internal one being much larger than the external. Length 480 to 550μ.

♀. Post-anal macrosetae are 25 to 32% of the length of the idiosoma; the anal slit extends right to the posterior edge of the hysterosoma; both latero-ventral apical setae of tarsi I and II are of the same length and thinner than in the ♂. Length 580 to 670μ.

In the larva, all the setae of the dorsal surface of the idiosoma are very short (the longest are sc e and h e and they do not exceed 10 to 15% of the idiosoma); p are longer than any of the others, but do not exceed 35 to 36% of the idiosoma; the "brustst iele" are short, of a regular cylindrical shape, with a truncate end, barely exceeding twice the diameter in length.

Distribution. It has been described from France, Holland, U.S.S.R. In U.S.S.R. up to the present, it has only been found in Moscow and its nearest suburbs (the village of Volhonskoje) and from Kiev.

Ecology. It lives in flour and, under experimental conditions, it is easy to culture; it is also found in sunflower seed and in damp seeds generally. Under field conditions, it has been found in field mice

burrows (Z.S. Rodionov) and in mole's burrows (Oudemans).

According to the results of O.K. Nastukova - A. ovatus flourishes in damp, warm conditions, the optimum temperature for breeding being 35°C. at 90% relative humidity (this corresponds to a humidity of 15 to 17% of the substrate); the minimum temperature at which breeding is at all possible is 22°C., and the minimum atmospheric humidity is 80%. The maximum temperature and humidity have not been established, but according to Smaragdova this species has a correspondingly high resistance to heat; when present in large numbers, A. ovatus can cause perceptible damage.

2. Aleuroglyphus siculus Fum. and Rob. (Fig. 123)

Fumouze and Robin, 1867, Journ. Anat. Physiol. IV, No. 6: 585, t. 24; Kramer, 1899: 141 (Tyroglyphus).

The colour of the gnathosoma and legs is less intense than in the preceding species; the external edges of the chelicerae are less convex and, therefore, they are more conical in shape.

V i are 4 times longer than v e and fairly clearly pectinate; both pairs of scapulars are of approximately the same length (45 to 50% of the idiosoma); l a are very short; d_2 20%; h e and h i are approximately equal to sc; d_3, d_4 and l p, both pairs of sa and the post-anals are very long (60 to 100% of the idiosoma) and form a fan-shaped tail streaming from the posterior end of the animal; all these setae are almost smooth. The pseudostigmatic organ is longer than v e, bent and serrated.

Tarsus I is almost 3 times, and tarsus IV 4 times, longer than its diameter at the base, nearly cylindrical; the external marginal ventral apical spine of the tarsus is slightly longer than the middle one; the apical dorsal seta of tibia IV is longer than the tarsus.

P_2 is shorter than p_1, p_3 is almost 3 times longer than p_2, the length of p_3 is about 90% of that of the idiosoma. The penis is tri-

angular, somewhat blunted terminally, barely longer than its width at the base; the anal copulatory suckers are large, resembling those of the Tyroglyphidae and separated from the anal setae by a great distance; the apical ventral spines of tarsi I and II are not hypertrophied. Total length (including the gnathosoma) is 230 to 350μ.

♂. The post-anal macrosetae are 60 to 70% of the idiosoma; the posterior end of the anal slit is remote from the end of the body. Total length is 250 to 650μ. Larvae and other stages have not been described in detail.

Habitat. Sicily, Azerbaidjan, (Armenia). The author has found it on a dry fly (which originally came from Sicily) in association with Thyreophagus entomophagus Lab. and isolated specimens of a Glycyphagus. Recently it has been found in granary dust from a collective farm at Azerbaidjan.

3. Genus Kuzinia gen. n.

Type species: Hypopus laevis Duj., 1849

This is closely related to the genus Aleuroglyphus, from which it differs in that d_2 are considerably displaced anteriorly, lying almost on the same transverse line as d_1, l a is very long, a longitudinal keel is present on the tibia and tarsi I and II, and straight apical spines are present on the tarsi.

Hypopus. The idiosoma is egg-shaped, with a tongue-shaped, flattened protruding posterior end and very wide, plate-shaped lateral edges, the width varying considerably with the degree of its flattening; the dorsal surface is smooth (very finely pectinate), and moderately convex. The setae of the dorsal surface are all represented by microsetae which form two, almost pyramidal, transverse rows; sa i are remote from the posterior edge of the body (which is consistent with its peculiar struc-

ture). The openings of the latero-abdominal or "fat" glands are placed on the side flange of the hysterosoma, approximately at the same level as 1 a. Eyes are absent.

The gnathosoma is unsegmented, and shaped like a trapezoid, its width at the base is considerably greater than its length. The sternal shield is sharply defined, its elongated, slightly indented lateral edges form, with the fleshy, convex posterior edge, rounded but absolutely clearly defined angles; epimeres II and the sternum are free, almost straight and do not nearly reach the posterior edge of the sternal shield. Coxal fields III are completely closed, widely pushed apart by coxal fields IV which are wedged between them, the latter are therefore open anteriorly and take part in the formation of a well-defined straight edge to the ventral shield; coxal fields IV are fused with each other and with the genital shield to form one plate. The surface of both shields (sternal and ventral) is regularly and densely cuticularised; the edge thickenings are narrow and more noticeable on the ventral shield. Coxal suckers are weakly developed.

The sucking disc is large, bearing 4 pairs of suckers and no additional ones. The legs are of medium length, protruding almost completely beyond the edges of the body; the ventral setae of the trochanters and of femora I and II are long; the ventro-lateral setae of the genua and tibiae I and II are smooth, thickish and thorn-like; the dorso-basal setae of the genu is short and the apex of genu I has only one seta. Tarsi I and II are fairly short; on tarsus I is a rod-shaped sensilla - gamma - placed nearer to the body than the main sensory rod; sensilla delta is absent; eta is a thick, smooth seta; the "sucking" seta is feebly developed; two of the apical and external ventral setae are large and leaf-shaped; on tarsi III and IV there is one fairly long macroseta.

1. Kuzinia Laevis Duj. (Fig. 81, 97, 98, 124, 159 to 163.)

Dujardin, 1849, Ann. Sci. Nat. (3) XII: 244, t. II, fig. 11-13 (Hypopus). fucorum Oudemans, 1902, Entomol. Ber. I No. 3: 17; 1924 Tijdschr. Entomol. XLVI 18, t. 3, figs. 38-40 (Tyroglyphus). - lundbecki Trägårdh, 1905, Fauna Arctica IV: 66 (Tyroglyphus). - echinopus Vitzthum, 1912, Ztschr. f. wiss. Insecktenbiol. 180, fig. 11 (Rhizoglyphus).

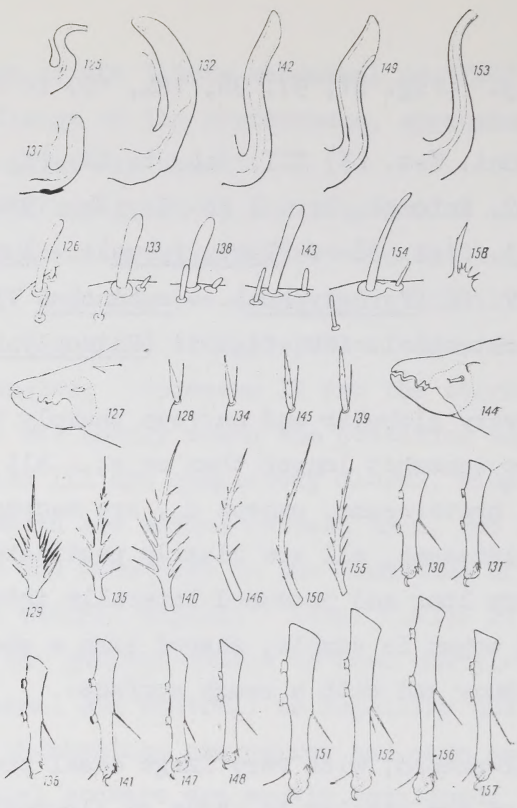
The idiosoma is very globular and narrows sharply towards the posterior end; sc i are somewhat longer than sc e; all the setae of the dorsal surface of the hysterosoma, except d_1, are macrosetae - 40 to 70% of the length of the idiosoma, all are clearly pectinate. The pseudostigmatic organ is very long and produced laterally into numerous processes. Grandjean's organ is simple, shaped like a shoemaker's needle, of a delicate consistency and with a rough surface.

♂. The penis is beak-shaped, with very large basal protrusions. The anal copulatory suckers are similar to those of Aleuroglyphus. Length 480 to 600μ.

♀. The adanal and posterior pair of anal setae are long and hair-like; the anal slit is noticeably moved away from the posterior edge of the body. Length 520 to 700μ.

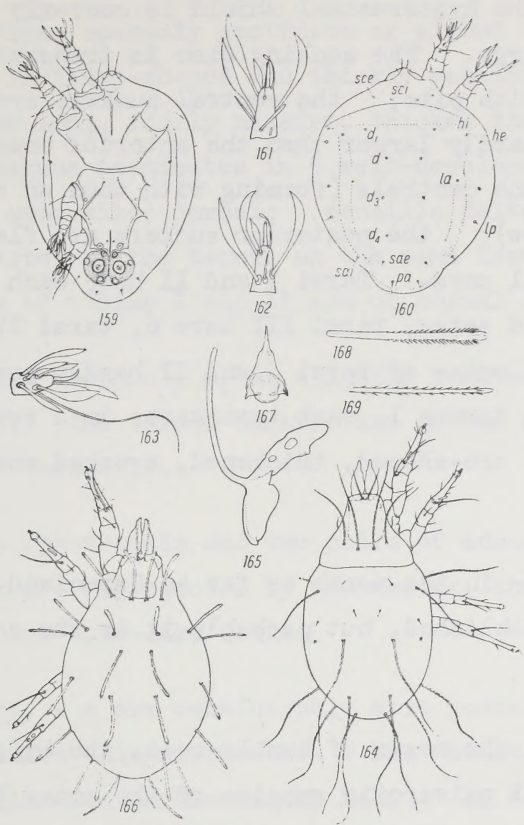
The larvae are characterised by having the v e setae in the same position as in the larvae of Aleuroglyphus and Tyrolichus, and also the long setae arising from the dorsal surface of the body in a fan-shape. In the protonymph, v e are displaced anteriorly and all the setae of the body become relatively short (20 to 23% of the length of the idiosoma), thickly pectinate and, except for d_1, of one type only. The telonymph already resembles the adult in structure.

The hypopus is a deep dirty yellow in colour. The propodosomal shield covers a fifth of the hysterosoma, it is sickle-shaped with a rostrum protruding anteriorly at an obtuse angle; sc are inserted on



Figs.125 - 158. Characters of the genus Tyrophagus.

Fig.125 - Tyrophagus noxius A.Z. lateral view of penis. Fig.126 - T. noxius A.Z., basal group of sensillae of tarsus I. Fig.127 - T. noxius A.Z., internal view of chelicera. Fig.128 - T. noxius A.Z., maxillary seta. Fig. 129 - T. noxius A.Z., pseudostigmatic organ. Figs.130,131 - T. noxius A.Z., tarsus IV, ♂ . Fig.132 - T. perniciosus, sp.n, penis. Fig.133 - T.perniciosus, sp.n., basal group of sensillae. Fig.134 - T. perniciosus, sp.n., maxillary seta. Fig.135 - T. perniciosus, sp.n., pseudostigmatic organ. Fig.136 - T. perniciosus, sp.n., tarsus IV, ♂ . Fig.137 - T. molitor, sp.n. lateral view of penis. Fig.138 - T.molitor, sp.n. basal group of sensillae. Fig.139 - T. molitor, sp.n., maxillary seta. Fig.140 - T. molitor, sp.n., pseudostigmatic organ. Fig.141 - T. molitor, sp.n., tarsus IV, ♂ . Fig. 142 - T. humerosus tesquorum, s.sp.n., penis, lateral view. Fig.143 - T. humerosus tesquorum, s.sp.n., basal group of sensillae. Fig.144 - T. humerosus tesquorum, s.sp.n., chelicera, internal view. Fig.145 - T.humerosus tesquorum s.sp.n., maxillary seta. Fig.146 - T. humerosus tesquorum s.sp.n., pseudostigmatic organ. Figs.147, 148 - T. humerosus tesquorum s.sp.n., tarsus IV, ♂ . Fig.149 - T. humerosus humerosus Ouds. penis, lateral view. Fig.150 - T. humerosus humerosus Ouds., pseudostigmatic organ. Fig.151, 152,- T. humerosus humerosus Ouds., ♂ , tarsus IV. Fig.153 - T. tenuiclavus, sp.n. penis, lateral view. Fig.154 - T. tenuiclavus, sp.n. basal group of sensillae. Fig.155 - T. tenuiclavus, sp.n., pseudostigmatic organ. Figs.156, 157 - T. tenuiclavus, sp.n., tarsus IV, ♂ . Fig.158 - T. tenuiclavus, sp.n. Grandjean's organ.



Figs.159 - 169

Fig.159 - Kuzinia laevis Duj., hypopus, ventral surface. Fig.160 - K. laevis Duj., hypopus, dorsal surface. Fig.161 - K. laevis Duj, hypopus, dorsal view of tarsus I. Fig.162 - Ditto, ventral view. Fig.163 - K. laevis Duj., hypopus, ventral view of tarsus III. Fig.164 - Forcellinia fungivora Ouds., ♀, dorsal surface. Fig.165 - F. fungivora Ouds., penis. Fig.166 - F. wasmanni Moniez, ♂, dorsal surface. Fig.167 - F. wasmanni Moniez, penis. Fig.168 - F. wasmanni Moniez, one of the setae of the idiosoma. Fig.169 - F. diamesa, sp.n., distal end of one of the idiosomal setae. The lettering is the same as in fig.27.

an arc which is slightly concave anteriorly; sa are well-developed; the anterior edge of the hysterosomal shield is convexly arched. The genital suckers are large. The sucking disc is transversely elliptical, densely covered with pits; the ventral suckers are very large, the lateral ones are hardly larger than the anterior ones and placed somewhat in front of the centrals (forming with them an anteriorly-concave, transverse row); the posterior suckers are fleshy, slightly larger than the lateral ones. Tarsi I and II have each 3 large and one small lancet-shaped setae, tarsi III have 6, tarsi IV 4 identical setae; the "sucking" setae of tarsi I and II hardly protrude beyond the end of the claw on tarsus I, each terminates in a very small "saucer"; on tarsus II it has an orb-shaped, thickened, crooked end. Length 300 to 390μ.

Habitat. Palearctic - in the north as far as Greenland. The southern limit has not been established, but probably it is the same as that of the genus Bombus.

Ecology. It lives in the nests of bumble bees, the hypopi are met with in large numbers on all palearctic species of the genus Bombus s. lat, infrequently on other bees (Xylocopa pavlovsky Popov, Osmia przewalskii F. Mor.).

4. Genus Tyrolichus Ouds.

Oudemans, 1923, Entomol. Ber., VI: 250.

Type species: Tyrolichus casei Ouds., 1910.

V e lateral, arising slightly posterior to a transverse line drawn through the bases of v i, long, thickly or thinly pectinate, somewhat curved and directed ventrally and internally, so as to enfold the sides of the gnathosoma; sc i equal to or even longer than sc e and represented by macrosetae; similarly, all the other setae of the hysterosoma,

except d_1 and l a, are also long; d_2 is of average length; all the setae are very fine, sparsely pectinate or almost smooth; the pseudostigmatic organ is lance-shaped and thickly pectinate.

The legs are long, fairly massive, thicker than in the genus Tyrophagus. Each tarsus terminates in 5 well-developed hook-shaped spines and one (of the same size) dorsal; sensilla delta of tarsus I is placed in the basal quarter of the tarsus on the same level as the sensory rod; the apical setae of tibiae I and II are of normal size.

♂. P_2 and p_3 are marginal, p_1 is slightly removed from the posterior edge of the body; the tarsal suckers are at the same distance from the base and apex of tarsus IV.

♀. Three pairs (post-anals and two pairs of adanals) of the setae of the anal complex are represented by macrosetae, the other four pairs by very thin, long and hair-like setae.

In the larva, v e are considerably more posterior in position than in the adult and are thin microsetae. The "bruststiele" are fairly short, barely thickened in the distal half. In the protonymph v e acquire a size approaching that of the adult, but their position is the same as in the larva; only in the telonymph are they inserted as in the adult.

A hypopus is probably not formed (those attributed to T. casei and described by Vitzthum 1926 are probably those of T. farinae).

Two species are known which were placed in 2 genera by Oudemans.

Tyrolichus Ouds.

1.(2) L a represented by long setae, of about the same length as the humerals, the dorsal surface of the hysterosoma with only 1 pair of microsetae (d_1). Holland, England, Germany, Italy,

U.S.S.R. (suburbs of Smolensk, Moscow, Ivanov, Odessa, Eastern Siberia.

1. T. casei Ouds.

2(1) L a represented by microsetae equal in length to d_1, Germany.

2. T. lini Ouds.

1. Tyrolichus casei Ouds. - The cheese mite. (Figs. 1, 39, 84, 99, 100)

Oudemans, 1910, Entomol. Ber. III, No. 53; 74; 1913, Arch. f. Naturg. LXXIX H.4, 10: 62 (Tyroglyphus); Entomol. Ber. VI 250 (Tyrolichus). - siro Canestrini, 1888: 402, t. 31, fig. 2; Michael, 1903, 117, t. XXXV-XXXVI, figs. 11 to 20 (Tyroglyphus).

The idiosoma is an elongated oval, with scarcely perceptible shoulder protrusions; v e are placed slightly posterior to a transverse line drawn through the bases of v i, they are about a quarter the length of v i; sc are placed on an arch which is concave anteriorly; sc i is 1.3 to 1.5 times longer than sc e. Of the setae of the dorsal surface of the hysterosoma, only d_1 is represented by a microseta approximately 5 to 7% of the length of the idiosoma; d_2 are 2.5 to 3 times longer than d_1, l a 4 to 6 times d_1 and represented by macrosetae varying in length from 30 to 60% of the length of the idiosoma, and all are sparsely, but clearly, pectinate. The pseudostigmatic organ is thickened at the base, with from 9 to 12 thin, needle-like projections. Grandjean's organs each consist of one linear protrusion with a truncate end, with an angular projection at the beginning of the distal half and 2 to 3 teeth at the base. Tarsus I is approximately 3 times longer than its diameter at the base. The sensory rod is straight, almost cylindrical, slightly expanded distally.

♂. Penis beak-shaped, almost straight, gradually narrowing towards a sharpened end, almost 3 times longer than its diameter at the base. The

anal suckers are rounded with a densely cuticularised peripheral ring, immediately in front of which are inserted thin anal setae; the distance between the tarsal copulatory suckers is slightly greater than their diameter. Length 360 to 480μ.

♀. The posterior edges of the genital folds form almost a right angle with the internal ones. Length 420 to 725μ.

In the larva d_2 is 5 times longer than d_1 and 40% of the idiosoma in length; the "bruststiele" are 3 times longer than their maximum diameter, with a straight, truncate end.

Habitat. It has been recorded from Holland, England, Italy, Germany; in U.S.S.R. it was found in Moscow in the Ivanovsk region, in many places in the Smolensk region, in the Ukraine, the Odessa region and Eastern Siberia (Irkutsk).

Ecology. A synantropic species which lives on cheese, in grain, seed bins and old honey combs, on dead insects (e.g. in collections); Michael found it on dry ergot. Recently it has been found by P.Chernishev under field conditions beneath the bark of old tree stumps. The biological and ecological importance of T. casei is not fully understood; in parts of France and Turingen it is especially cultured and used in cheese-making for imparting a special aroma, and also for faking the external appearance.

2. Tyrolichus lini Ouds.

Oudemans, 1923, Entomol. Ber. VI: 307 (Tyroborus).

This species is insufficiently known; it differs in being smaller (the length of the ♂ is 280μ) and l a being short and represented by microsetae - like d_1 - and in having v e slightly more displaced anteriorly; (v e are on the same transverse line as v i).

Habitat. Germany, where it was found only once on linseed.

5. Genus Tyrophagus Ouds.

Oudemans, 1923, Entomol. Ber. VI: 250.

Type species: Tyroglyphus putrescentiae (Schrank 1781?) Ouds. 1905

Chelicerae of normal length, not exceeding three-fifths of the length of the propodosoma; v e lateral in position, on the same transverse line as v i, they are long, finely pectinate, enveloping the sides of the gnathosoma, their free ends being directed ventrally and internally; sc i are always noticeably longer than sc e; of the setae of the dorsal surface of the hysterosoma, d_1, l a and sometimes d_2 are the only microsetae, all the rest of the setae are very long (50 to 100% of the length of the idiosoma), sparsely and finely pectinate, forming terminally a long spreading "tail". The structure of the pseudostigmatic organ is variable. Grandjean's organ has one linear protrusion and a finely toothed fold at the base. The legs are long and slender; the end of the tarsus is without a dorsal spine and has 3 small, straight ventral spines (both externo-lateral, i.e. fourth and fifth ventral, and dorsal spines are rudimentary and are visible only at the highest magnification); sensilla delta of tarsus I is placed considerably in front of the base of the sensory rod; the apical setae of tibia I and II are of normal size.

♂. P_2 and p_3 are macrosetae and form an arched transverse row along the posterior edge of the hysterosoma; p_1 are short and are placed considerably in front of them. The anal copulatory suckers are oblique, more or less egg-shaped, feebly outlined anteriorly (without a peripheral cuticularised ring); the position of the tarsal suckers is very variable.

♀. The post-anal and the posterior pair of adanals are macrosetae.

Larva. The position of v e and their relative lengths is the same as in the adult; sc e are much shorter than sc i, and are microsetae; sa e are also short; sa i are longer than any other setae and function

as caudal setae; p a are much shorter than sa i. The "bruststiele" are long, slender, thickening towards the end. The hypopial stages of species of this genus do not exist.

A cosmopolitan genus, up to the present the systematics of the genus Tyrophagus have been in a chaotic state. Certain authors (Michael, Berlese, Vitzthum) regarded all its representatives as belonging to one, greatly variable species, which they called T. longior Gerv. or T. dimidiatus Herm. Others (Oudemans 1926) endeavoured to divide this complex into a series of smaller "species" (T. humerosus, T. viviparus, etc.), but these attempts were unfortunately not crowned with success. This was due to an unsuccessful choice of characters taken as the basis for the difference between the species, as well as a real difficulty in finding characters which must be different from the family norms; the majority of characters taken were parts of organs not usually studied in detail (gnathosoma, sensory apparatus of the anterior tarsi, the copulatory organ of the ♂, the proportions of the individual joints of the legs). Thus great difficulties arise when comparing the names of the species described in the literature with those in the present work, and I was obliged to abandon many of these names as unusable. Thus I did not find it possible to connect the oldest name putrescentiae Schrank with any forms, since Schrank's description does not contain sufficient characters to identify it; and speaking candidly, it is very difficult to recognise representatives of the genus Tyrophagus from illustrations accompanying the descriptions. According to Oudemans, T. putrescentiae is a synonym for T. longior Gervais, and he also included here all other representatives of the genus Tyrophagus, until he discarded it completely in favour of the name dimidiatus Herm. 1804, which had also been used for all representatives of the genus for a long time. In my opinion, Hermann's name must undoubtedly refer to one of the field species of the Tyrophagus group, such as T. humerosus, but to exactly which one it is impossible to say, without studying topotypical material from Alsace (from moss). I regard T. infestans Berl. 1881 (nec Oudemans 1926)

as a synonym for T. longior Gervais, this is probably also the same as T. viviparus Ouds. 1926. As regards T. infestans Ouds. 1926 (nec Berlese 1881), this is probably no other than the form named by me, somewhat arbitrarily, T. humerosus Ouds.

Tyrophagus Ouds.

1(4) D_2 2.5 to 4 times longer than d_1; legs relatively short, less thin; tarsus I not longer than the tibia and genu taken together; tarsal copulatory suckers of the ♂ at about the same distance from the base and apex of tarsus IV.

2(3) D_2 2.5 to 3 times longer than d_1; penis small, sharply recurved into an S; pseudostigmatic organ lanceolate with long protrusions arising at a sharp angle from the swollen basal half; conical tubercle of the internal surface of the chelicera more proximal in position than the mandibular seta, and drawn out into a fine long point; coxo-lateral spine fusiform; famulus oval. Species considerably smaller. U.S.S.R. (Leningrad, Moscow, Novotcherkassk, Armavir, Azerbaidjan, Central Asia, Far East.

1. T. noxius A.Z.

3(2) D_2 3.5 to 4 times longer than d_1; penis very large and curved into an arc; pseudostigmatic organ with a narrow stalk and protrusions that are sparser along two-thirds of its length; the conical tubercle on the chelicera is less pointed and nearer to the mandibular seta; maxillary seta and famulus feebly thickened. Larger in size. ♂ 450 to 540μ; ♀ 550 to 700μ. U.S.S.R. (Kostroma, Caucasus, Barnaoul).

2. T. perniciosus sp.n.

4(1) D_2 equal to d_1 in length or a little (not more than 1.6 times) longer; legs long and thin; tarsus I often longer than the tibia and genu taken together; copulatory suckers arranged differently.

5(6) Legs very long and thin; tarsus I nearly 1.5 times, tarsus IV 1.45 to 1.6 times longer than the tibia and genu together; maxillary seta fairly long, not thickened; the two ventral setae of tarsus IV are situated in the distal third of the tarsus; idiosoma relatively narrow, nearly twice as long as wide. England, France, Italy.

6. T. longior Gervais.

6(5) Legs shorter; tarsus I not more than 1.5, tarsus IV 1.3 times as long as the tibia and genu taken together; maxillary seta short, wide; ventral setae of tarsus IV situated near the middle of the tarsus; idiosoma wider.

7(8) D_2 1.3 to 1.6 times longer than d_1; tarsus I 1.04 to 1.16 times, tarsus IV 1.11 to 1.3 times longer than the genu and tibia together; penis thin, cylindrical, gradually tapering towards a fine point, truncate, resembling in shape the spout of a coffeepot; the two tarsal copulatory suckers situated in the proximal half of the tarsus; sensory club of tarsi I and II very long, thin, perceptibly narrowing towards its end. U.S.S.R. (suburbs of Leningrad, Kalinine, Ivanov, N. Caucasus, Kamtchatka).

5. T. tenuiclavus sp.n.

8(7) D_2 equal to d_1 in length; tarsus I not longer than tibia and genu taken together; tarsus IV not more than 1.08 (♂) to 1.2 (♀) times longer than tibia and genu IV; penis shaped differently; tarsal copulatory suckers disposed in various ways; sensory club of tarsi I and II shorter and thicker, becoming wider towards its end.

9(14) Penis bent twice, widening towards its end which is obliquely truncate, stout; stalk of the pseudostigmatic organ not widened; famulus of tarsus I not swollen. Holland, Germany, U.S.S.R. (suburbs of Leningrad, Moscow, Ivanov and Odessa, Bachkiria,

N. Caucasus and East Siberia).

4. T. humerosus Ouds.

10(11) Distal curve of penis feeble; tarsus IV shorter, only 0.93 to 1.07 (♂) or 0.98 to 1.10 (♀) the length of tibia and genu taken together; arrangement of the tarsal copulatory suckers very variable; segment ef equal to 0.75 to 1.75 of segment ab; the latter is 1.5 to 3 times longer than the space between the suckers; small in size. ♂ 288 to 370μ, ♀ 350 to 455μ. U.S.S.R. (Bachkiria, Caucasus).

4c. T. humerosus tesquorum s.sp.n.

11(10) Distal curve of penis very pronounced; tarsus IV longer, 1.03 to 1.08 (♂) or 1.03 to 1.23 (♀) of the length of tibia and genu taken together; segment ef 1.5 to 2.5 times longer than ab.

12(13) Larger in size (♂ 470 to 766μ, ♀ 470 to 770μ); segment ef of tarsus IV 1.45 to 2.5 times greater than segment ab, the latter is 1.25 to 2.8 times greater than the space cd between the suckers. Holland, Germany, U.S.S.R.

4a. T. humerosus humerosus Ouds.

13(12) Smaller in size; ♂ 280 to 380μ; ♀ 380 to 475μ; segment ef 2 to 2.2 times greater than ab, the latter is 1.25 to 1.35 times greater than the space between the suckers. U.S.S.R. (Odessa region).

4b. T. humerosus silvester s.sp.n.

14(9) Penis short, arc-shaped or straight, with thickened base, rounded at the end; stalk of pseudostigmatic organ lanceolate; famulus of tarsus I ovoid, thickened. Larger in size. Length ♂ 515 to 520μ; ♀ unknown. U.S.S.R. (Saratov).

3. T. molitor sp.n.

1. Tyrophagus noxius A.Z. (Figs. 36 to 38, 122, 125 to 131.)

Zachvatkin, 1935: 25 - bülleri, Voloshiuk, 1936, Plant Protection 8:155.

A small species with pale, almost non-pigmented limbs. A conical protrusion of the internal surface of the chelicera is placed considerably posterior to the mandibular seta (and more proximal to the body) and is extended into a long thin spike; the maxillary seta is sharp, smooth and thickened like a spindle. D_2 is 2.5 to 3 times longer than d_1 and l a; the pseudostigmatic organ is flattened, lance-shaped, with long protrusions arising only from the broadened proximal part, the apex being stretched into a long thin point.

The legs are relatively short, tarsus I not exceeding the total length of tibia and genu I; the sensory rod of tarsi I and II is fairly long, almost cylindrical, very faintly enlarged at the end and slightly arched. Sensilla beta of tarsus I is egg-shaped; the ventral setae of tarsus IV are placed near the middle of the segment. There are no sclerotised regions surrounding the epimeres.

♂. The penis is very small and sharply S-shaped, its proximal part is laterally compressed and flattened into a plate, so that the ventral edge forms a protruding obtuse angle, whilst the distal part is almost cylindrical and gradully becomes narrower towards its very thin end. Tarsus IV is slightly shorter than the sum of the genu and tibia; the tarsal suckers are placed almost at the same distance from the base and apex of the joint, sections ab and ef being almost equal; the distance between the suckers usually equals the distance from the base and apex of the joint. Length 280 to 350μ.

♀. Tarsus IV is approximately equal to the tibia and the genu. Length 320 to 415μ.

Larva. Sc i equals twice the length of sc e; both pairs of h are almost equal in length; d_2 is almost twice as long as d_1 and l a; d_3 is noticeably shorter than sc i and more than half sa i, considerably

shorter than the idiosoma; sa e are only 1.5 times longer than l a. The "bruststiele" are 13 to 14μ in length.

Habitat. It is certainly only found in Leningrad, Moscow, Novocherkassk, Armavir and a series of places in Azerbaidjan, Central Asia and the Ussurisk region (the town of Voroshilov - Ussurisk).

Ecology. It lives in granaries and stores of wheat, barley, flour, various seeds and other plant products causing serious damage; in the Southern region of the U.S.S.R. it is one of the most destructive species of granary mites. According to O.K. Nastukova the maximum temperature at which reproduction can occur is from 25 to 30°; at 35° no increase in population takes place; breeding, however, occurs at low temperatures (9 to 10°C), although the optimum is from 23 to 25°C.

The optimum humidity for T. noxius is from 85 to 90%, but at 80% it develops fairly well, especially at temperatures approaching the optimum. It has not yet been found under field conditions, although when sieved with grain in the field (these experiments were carried out in the region of Kerjach Ivanov), specimens remained alive throughout the vegetative season. There are no accurate investigations of the real detrimental effect of T. noxius, but under laboratory conditions it is very great; when a sufficient concentration of the mites is present in wheat, the whole contents of the seed (including the endosperm) are completely eaten away, leaving only the seed coat.

2. Tyrophagus perniciosus sp.n. (Figs. 83, 132 to 136)

This is very similar to the preceding one, but considerably larger. The legs and gnathosoma are usually strongly pigmented. D_2 is 3.5 to 5 times longer than d_1; the pseudostigmatic organ has a narrow, almost unwidened stem, with long protrusions which are more widely spaced; these diverge away from the stem.

The legs are relatively short and massive; tarsus I does not exceed the total length of the two previous segments taken together; the

sensory rod is short, massive, almost straight, only slightly swollen into an egg-shape distally; sensilla beta is rod-shaped.

♂. The penis is large, arc-shaped, somewhat laterally compressed in the basal half and broadening into a funnel towards a sloping end. The proportions of tarsus IV and the position of the suckers resemble those of T. noxius. Length 450 to 500μ.

♀. Tarsus IV approximately equals the tibia and genu together. Length 550 to 700μ.

Distribution. It has been recorded fromthe U.S.S.R. It has been found in Kostroma, in Barnaul and many other districts of the Krasnodask and Otdjonikidzevsk districts, where it is one of the most common and numerous species of the genus Tyrophagus and is frequently found under field conditions.

Ecology. It lives in grain (mainly in oats and barley), in various grain products (cereals, etc.), in oil-producing seed and probably many other plants stored in granaries and warehouses; it also lives in soil and collections of the most varied dead plant residues (Minenkova 1934, Zachvatkin 1936). There is no special laboratory work on the ecology of T. perniciosus.

Damage. According to V.P. Romanov's data (1936), the damage to grain (wheat) caused by this species (referred to in her work under the name of putrescentiae Schrank) is similar to that caused by the flour mite T. farinae. T. perniciosus is closely allied (like the preceding species T. noxius) to T. americanus Banks 1906, which damages grain in the U.S.A., and also to T. castellanii Hirst 1915, which is described from specimens found in Ceylon; it is very possible that it may be identical with this speci e s.

3. Tyrophagus molitor, sp.n. (Figs. 137 to 141)

This resembles T. perniciosus, differing in the shortness of d_2, the structure of the penis and chaetotaxy of tarsus I. D_1 is equal to d_2 and l a; the pseudostigmatic organ is lance-shaped, broadened, with long barbs in the basal half, and with an apex prolonged into a long smooth point.

The legs are fairly short; tarsus I is shorter than the tibia and genu taken together. The sensory rod is fairly short and thick, almost cylindrical and bent; beta is thickened into an egg-shape.

♂. The penis is small in size, slightly S-shaped, with thick strongly-cuticularised walls and a blunt, rounded end. Tarsus IV is somewhat shorter or equal in length to the two preceding joints taken together; the suckers are arranged as in T. perniciosus. Length 515 to 520μ.

♀. Unknown.

Distribution. It has been described from 2 males found in Seratov. These were found in the yard of a mill under rubbish beneath wooden flooring.

4. Tyrophagus humerosus Ouds. (Figs. 89, 142 to 152.)

Oudemans, 1923, Entomol. Ber. V.

The conical protruberance on the internal surface of the chelicera is massive, blunt or slightly sharpened, closely displaced towards the mandibular seta. The maxillary seta is thick, but not spindle-shaped, clearly serrated. D_2 and d_1 and l a are short and of equal length; the pseudostigmatic organ has a few short protrusions and a cylindrical, not widened trunk.

The legs are of moderate length; tarsus I is slightly shorter and equal in length to the two preceding segments taken together; the sensory rod is almost straight, fairly massive, slightly thickened

towards the end; sensilla beta of tarsus I is rod-shaped; the epimeres are often surrounded by an irregularly shaped, sclerotised formation.

♂. The penis is large, thin-walled, bent twice, the distal bend widening like a funnel towards its end, which is obliquely truncate. The relationship of tarsus IV to the length of tibia and genu taken together varies within the limits of 0.94:1 to 1.08:1. The position of the suckers is more variable than in other species of Tyrophagus. Length 280 to 465μ.

♀. The length of tarsus IV is equal to 0.98 to 1.22 of the total length of tibia and genu IV, i.e. it is more variable than in other species. Length 350 to 700μ.

Larva. Sc e is longer than half the length of sc i; h i is twice the length of h e; d_1, d_2 and l a are equal to about one-third of sc i; d_3 is very long, twice as long as sc i; sa i is 1.75 times longer than d_3 and considerably longer than the idiosoma; sa e are more than twice as long as l a; the "brustst iele" are about 18μ long.

Distribution. It has been only recorded from Holland, Germany, U.S.S.R. - from Leningrad, Moscow, Ivanov and Odessa regions, from Bashkiria, Krasnodarsk and the Ordjonikidzevsk and also from Western Siberia. T. humerosus can be divided into 3 geographical races.

4a. Tyrophagus humerosus humerosus (Ouds.) A.Z. (Figs. 89, 149 to 152)

A large form, the ♂ being 370 to 465μ, the ♀ 470 to 770μ in length. The pseudostigmatic organ is bristle-like, noticeably bent into an S-shape, its pectinations similar to those found on the long setae of the hysterosoma - very short and sparse.

The legs are usually pigmented, the epimeres often surrounded by irregularly shaped, sclerotised thickenings.

♂. The distal bend of the penis is sharp. The relationship of the length of tarsus IV to tibia and genu IV varies within small limits - 1.03 to 1.07:1; section ef is 1.5 to 2.5 times greater than ab, the latter exceeds the distance between the suckers by 1.25 to 2.8 times. Length 370 to 465μ.

♀. The relationship of length of tarsus IV to that of tibia and genu is 1.03 to 1.22:1. Length 470 to 770μ.

Distribution. Holland, Germany, U.S.S.R. It has been found in many parts of Ivanov, Moscow, Kalininsk and the Leningrad area and the surroundings of Novosibirsk.

Ecology. It is found almost exclusively in the field, living in hay, straw and other dead plant residues (it is often found in ricks and stacks). In the soil it is often found on the subterranean parts of living plants, as well as on the aerial parts; it is often found on the plumules of cultivated cereals, causing a lot of damage, and on the leaves of cucumbers and other Cucurbitaceae infected with Tetranychidae.

4b. Tyrophagus humerosus silvester s.sp.n.

This is allied to the typical form, but is small. The pseudostigmatic organ is thin and bristle-like.

♂. The distal bend of the penis is abrupt, the distal segment being somewhat longer than in the typical form. The relationship of tarsus IV: tibia plus genu is 1.04 to 1.08:1; the distribution of the suckers is very constant, the section ef is 2 to 2.2 times greater than ab, the latter is 1.25 to 1.35 times greater than the distance between the suckers. Length 280 to 380μ.

♀. The relationship of tarsus IV: genu plus tibia fluctuates between 1.05:1 and 1.25:1. Length 380 to 475μ.

Distribution. It has been recorded from only one place - Nerubaevsk forestry station in the Odessa region. It lives in the dead vegetation of oak forests.

4. Tyrophagus humerosus tesquorum s.sp.n. (Figs. 142 to 138.)

This is allied to the preceding subspecies as regards size, but differs in the structure of the pseudostigmatic organ and penis; it has slightly shorter legs and the position of the tarsal copulatory suckers is, in the ♂, strikingly variable. The pseudostigmatic organ is straight, with fairly long barbs, considerably bent away from the main stem at the base.

♂. The distal end of the penis is less abruptly bent than in the other subspecies of T. humerosus. The relationship of the length of tarsus IV to the genu plus tibia is 0.94 to 1.07:1; the distribution of the suckers is very variable, they are either close to the proximal end of the tarsus, as in the other forms belonging to the T. humerosus group, or they are placed in the same way as in T. noxius. Length 288 to 370μ.

♀. The relationship of the length of tarsus IV: tibia plus genu is 0.98 to 1.11:1. Length 350 to 465μ.

Distribution. It has been recorded from Bashkiria (from many places) and north of the Caucasus (near the town of Voroshilovsk).

Ecology. It is widely distributed in fields like the typical form, but it is also found in rodent burrows and often penetrates into village granaries. In southern regions, where it lives in fields together with T. perniciosus, the latter replaces it in most habitations; it is found almost exclusively in habitats which are outside the ecological range of T. perniciosus, on the subterranean parts of the vegetation and on aerial parts.

5. Tyrophagus tenuiclavus sp.n. (Figs. 86, 101 to 103, 153 to 158.)

A fairly large species which is closely related to T. humerosus, but easily distinguished from it by having longer legs, a different shaped penis, etc. D_2 is 1.4 to 1.6 times d_1; the stem of the pseudostigmatic organ is not widened at the base and its barbs are of medium length and all about the same length (with the exception of the most distal ones).

The legs are fairly long (tarsus I is 1.04 to 1.6 times longer than the tibia plus genu) and usually feebly pigmented. The sensory rod is very thin and long, noticeably thinner towards its end, its length exceeds the diameter of the middle of the tarsus.

♂. The penis is of medium size, slender, slightly S-shaped, gradually becoming narrower towards a very narrow obliquely cut end; in shape it resembles the spout of a coffee pot. Tarsus IV is 1.10 to 1.26 times longer than the tibia plus genu; both suckers are placed in the proximal half of the tarsus. Length 330 to 535μ.

♀. Tarsus IV is 1.18 to 1.3 times longer than the tibia plus genu, very slender. Length 530 to 670μ.

Distribution. It has certainly only been recorded from the U.S.S.R, where it has been found in Moscow and its suburbs, in Leningrad, Kalininsk, the regions of Ivanovsk, N. Caucasus (Mozdok) and in Kamchatka (surroundings of Petropavlovsk).

Ecology. It has been found mainly on decomposing vegetables in storage, as well as in vegetable gardens; Z.S. Rodionov found it in N.Caucasus (in large numbers on decaying windfall apples in orchards); it has also been found in stooks and other collections of dead vegetable remains.

6. Tyrophagus longior Gerv.

Gervais, 1844, in Walckenaer, Hist. Nat. Ins. Apt., III 262, t. 35, fig. 5; Fumouze et Robin, 1867, Journ. Anat. Physiol. IV, No. 6: 582, t.25 (Tyroglyphus) - infestans Berlese 1884, XIV, No. 6; Canestrini, 1888b, 405, t. 32, fig. 1 (Tyroglyphus).

This species is unknown to me. It differs from all other species of the humerosus group in having a narrower and elongated idiosoma and very long and slender legs. The maxillary seta is longer than in other species, thin and smooth. D_2 is short, equal in length to d_1 and 1 a. The pseudostigmatic organ has a stem, of even diameter like a seta, produced into fairly long barbs almost to the apex, which are slightly bent away from the stem.

The legs are long and thin. Tarsus I in both sexes is approximately 1.5, tarsus IV 1.45 to 1.6 times longer than the tibia plus genu. Both ventral setae of tarsus IV are placed in the distal third of the tarsus. The sensory rod is almost cylindrical, barely thickened towards its rounded end, fairly long.

♂. The penis is not large, S-shaped and tapering distally. Both tarsal suckers are placed in the proximal third of the tarsus, i.e. considerably nearer the base than in other species. Total length of body is 170 to 460μ, according to Fumouze and Robin, and up to 350μ according to Berlese, and 550μ according to Canestrini.

♀. Length 200 to 750μ.

Distribution. W. Europe, England, France, Italy.

Ecology. A synantropic species living mainly on old cheese; Fumouze and Robin found it on a dry fungus; experiments which they carried out in transferring T. longior to decaying flour gave a negative result (the mites died in 2 days), indicating that in comparison with other species, T. longior is less elastic in its requirements. The name T. longior

Gervais up to now has included all the synantropic species of the genus Tyrophagus, of which there are several.

6. Genus Forcellinia Ouds.

Oudemans, 1924, Entomol. Ber., VI. 231. - Mycetoglyphus Oudemans, 1932, ibid. VIII, No. 183: 358 (part).

Type species: Tyroglyphus wasmanni Moniez. 1892.

The chelicerae are of normal size; v i 5 to 7 times longer than v e; v e are smooth, slightly pectinate microsetae, almost dorsal in position, and considerably posterior to a transverse line drawn through the bases of v i (almost at a quarter of the distance between this line and the scapular setae); both pairs of sc are equal in length or else the internal ones are longer than the external. All the setae of the hysterosoma are medium in length and of one type, they may be (and this applies also to sc and v i) flattened or thickly pectinate and ending in a peculiar oval plate; or d_1, d_2 and l a may be represented by smooth microsetae of normal structure. On the other hand, the size and structure of the setae may be intermediate between the two extremes. The pseudostigmatic organ is bristle-like, sometimes slightly pectinate, Grandjean's organ is simple, straight and rodlike, with a truncate end and an angular protrusion in the distal half.

The legs are fairly long and slender, the ends of the tarsi with a well-developed conical, dorsal spine and five ventral ones; sensilla gamma of tarsus I is considerably more distal than the sensory rod; the apical seta of tibia i and II is normal in size.

♂. P_2 are represented by small setae (not more than twice as long as p_1) placed at a considerable distance from the posterior edge of the body, and forming, with p_1, the figure of an inverted trapezium (as in most Acotyledonini); p_3 are long and marginal in position. The anal

suckers have no peripheral cuticularised ring as in the genus Tyrophagus; the tarsal suckers are placed in the proximal half of tarsus IV.

♀. The macrosetae are represented by only one pair of postanal setae.

Larva. The position of v e and their relative length do not differ from those of the adult; in their length, the terminal setae - sa i - exceed all the others in the body; the "bruststiele" are long and slender, thickened distally like an orb.

Hypopus. Only three species are known. The idiosoma has a smooth, very strongly convex dorsal surface and plate-like edges reflected on to the ventral side; all the setae covering it are extremely small. The propodosomal shield has a weakly projecting rostrum, or is without one; it is faintly arched with an almost straight anterior edge. V i are small or absent. The openings of the "fat" glands are dorsal, directly behind the humeral setae, or else on the same level ventrally. Eyes and pseudostigmatic organs are absent. The gnathosoma is medium in length, from 2 to 3.5 times its own breadth; it is unsegmented. The sternal shield is well defined, with long lateral edges forming a definite angle with the posterior edge; the sternum and epimeres II reach to its posterior edge, thereby closing coxal fields I and II; the external edges of coxal fields I are separated from epimeres II by narrow, flat, soft cutic le, so that the sternal shield becomes divided into three independent shields (the unpaired central one is formed by coxal fields I and II, the lateral ones by coxal fields II); coxal fields III are closed and divided along the middle line of the body by a narrow ventral seam, far behind the anterior edge of the ventral shield; the genital shield is clearly separated from the ventral one by an arched or wavy line; the entire surface of the ventral shield is regularly and densely cuticularised, without any particularly noticeable thickening of the edges. The coxal suckers are well-developed; the sucking disc is rounded, the external suckers placed considerably in front of the central ones.

Legs I and II are fairly long, almost completely protruding beyond

the edges of the idiosoma; the ventral setae of the trochanter and femur are short; the ventro-lateral setae of the genu and tibia are smooth and thickened to form spines; the basal setae of the genu are very short; the apex of the genu has only one seta dorsally. The tarsi are slender, gamma is bristle-like and takes the form of a fairly strong, S-shaped seta; the sucking seta of tarsus I has a large or medium "saucer", on tarsus II it is only slightly thickened distally; the middle ventral seta is spine-like, the external seta and internal ventral and apical setae are all simple and slightly widened like blades. Tarsi III and IV have strong, partially serrated setae and no macrosetae.

To the genus Forcellinia belong 4 palearctic species; it is quite possible that Tyroglyphus lintneri Osborn 1876 - a N. American mushroom pest - should also be included here.

Forcellinia Ouds.

Adults

1(2) D_1, d_2 and l a represented by fine, smooth microsetae of the same length (4 to 7% of the length of the idiosoma); all the other setae of the dorsal surface of the idiosoma are very long (40 to 60% of its length), normal in structure, gradually narrowing towards the end, very sparsely and finely pectinate; sc i noticeably longer than sc e; penis extraordinarily long and thin. General appearance similar to species of the Tyrophagus humerosus Ouds. group. England, European parts of the U.S.S.R.

1. F. fungivora Ouds.

2(1) D_1 flattened, enlarged distally, densely pectinate at the sides, about 15% of the length of the idiosoma, d_2 and l a nearly twice as long as d_1; all the remaining setae of the dorsal surface of medium length, flattened, widening towards the apex to form a transparent oval or lanceolate lamella, and very pectinate laterally; or else longer and feebly pectinate with a very

narrow apical lamella; both pairs of sc of equal length; penis of normal size.

3(4) All the setae of the dorsal surface of the idiosoma flattened, enlarged at the end, each end forms an oval or widely lanceolate lamella, which is relatively short; in the ♂ p_1 and p_2 are almost of the same length. Exclusively myrmecophilous, Holland, Bohemia, U.S.S.R. (suburbs of Moscow and Kalinin).

4. F. wasmanni Moniez.

4(3) D_1 spatulate, densely plumose; all the rest of the setae thin and feebly and finely pectinate, terminating in a fine lanceolate lamella, variable in length (13 to 45% of the length of the idiosoma); in the ♂ p_2 are nearly twice as long as p_1. Found in the dead leaf litter of forests - U.S.S.R. (Moscow).

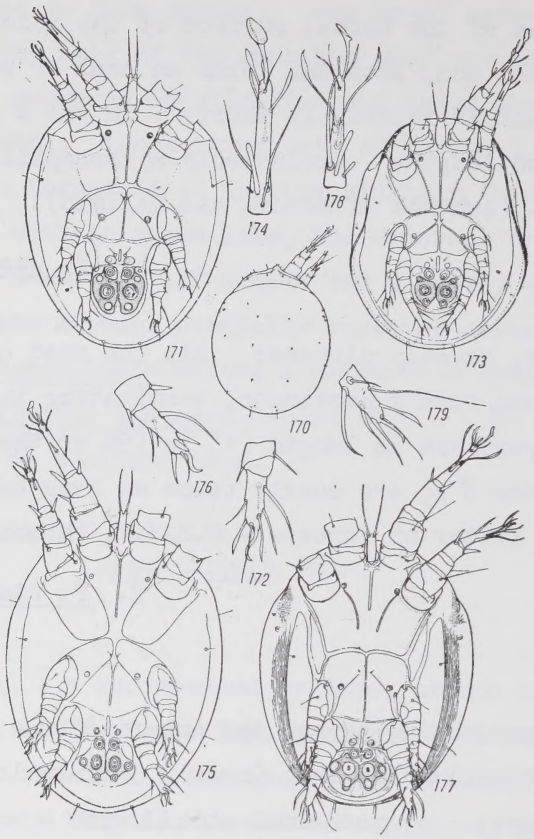
2. F. diamesa sp.n.

Hypopi

1(2) Gnathosoma projecting beyond the anterior edge of the idiosoma by all its distal half, long (nearly 3 times longer than wide), with parallel edges; propodosomal shield with a small, but very distinct rostrum, bearing on its end two small setae (v i) and not concealing like a visor the bases of legs I and II; rose brown in colour - Holland, Bohemia, U.S.S.R. (suburbs of Moscow and Kalinin.

4. F. wasmanni Moniez.

2(1) Gnathosoma short (not more than twice as long as its width at the base), entirely hidden, like the proximal joints of legs I and II, beneath the propodosomal shield, which covers them like a visor; the anterior edge of the shield is almost straight (barely arched), without any trace of rostrum; v i absent; yellow brown in colour.



Figs.170 - 179

Fig.170 - Forcellinia wasmanni Moniez, hypopus, dorsal surface. Fig.171 - Ditto, ventral surface. Fig.172 - F. wasmanni Moniez, hypopus, tibia and tarsus IV, dorsal view. Fig.173 - F. fungivora Ouds., hypopus, ventral surface. Fig.174 - F. fungivora Ouds., hypopus, tarsus I, dorsal surface. Fig.175 - Robinisca mycolicha Ouds., hypopus, ventral surface. Fig.176 - R. mycolicha Ouds., hypopus, tibia and tarsus IV, ventral view. Fig. 177 - R. macrocnemis, sp.n., hypopus, ventral surface. Fig.178 - R. macrocnemis, sp.n., hypopus, tarsus I, dorsal view. Fig.179 - R. macrocnemis, sp.n., hypopus, tarsus IV, ventral view.

3(4) A small species (about 260μ); coxal fields II narrowing slightly behind, so that their external edges are oblique; posterior edge of the ventral shield with a wavy outline; peripheral suckers of the sucking disc slightly smaller than the central - England, European part of the U.S.S.R.

1. F. fungivora Ouds.

4(3) A large species (460μ); coxal fields II distinctly widening behind, so that their external edges are almost parallel; posterior edge of the ventral shield arched; peripheral suckers of sucking disc much smaller than the central. Germany.

3. F. gigantonympha Vtz.

1. Forcellinia fungivora Ouds. (Figs. 4, 82, 104 to 106, 164, 165, 173, 174.)

Oudemans, 1932, Entomol. Ber. VIII, No. 183: 360 (Mycetoglyphus).

Very similar in appearance to T. humerosus. V e are smooth, sc i longer by a fifth to a quarter than sc e, which are approximately 40% of the idiosoma in length; h e are 1.5 times longer than h i; d_1, d_2 and l a are approximately equal in length, represented by smooth microsetae - 4 to 7% of the idiosoma; all the remaining dorsal setae of the hysterosoma (including sc i and v i) are thin, sparsely pectinate macrosetae, their length being 35 to 60% of the idiosoma, and they form a "train" as in the genus Tyrophagus; the longest setae are d_4, sa i and d_3. The pseudostigmatic organ is smooth and bristle-like.

♂. P_2 1.5 times longer than p_1 and one-third of p_3; p_3 are 40% of the idiosoma in length; the distal part of the penis (stiletto) is drawn out into an exceptionally long thin tube (longer than the tibia plus tarsus IV); the ventral apical setae of tarsus I are normal. Length 410 to 490μ.

♀. The post-anal setae are smooth and 30% of the idiosoma in length. Length 520 to 600μ.

Hypopus. Yellow-brown in colour. The idiosoma is shaped like a truncated ellipse, it is approximately 1.25 times longer than its maximum width, which is considerably behind the middle of the animal; its posterior edge is widely rounded. The length of the propodosomal shield is one-sixth of the hysterosoma, protruding anteriorly like a peak, with an almost straight, slightly convex anterior edge and rounded anterio-lateral angles; there are no signs of a rostrum and v i are absent. The gnathosoma is twice as long as wide, narrowing towards its forked end and completely hidden by the propodosomal shield. The external edges of coxal fields II converge posteriorly and the posterior edge of the ventral shield has a wavy outline. The length of the sucking disc is barely less than its width, the distance between its posterior edge and that of the body is considerably shorter than the length of the disc.

The ventro-lateral setae of the tibia and genu are fairly short, and the external and internal ventral setae of the tarsi are also widened in the form of leaves, as well as the internal apical one; the "sucking" seta of tarsus I has a thick stalk and a very large, straight elongated saucer which is not reflected back. Tarsus IV has 2 widened lancet-like setae, its basal seta is smooth and the medium dorsal one is shorter than the tarsus. Length 250μ, width 200μ.

Distribution. It has certainly only been found in England and in the central and northern region of the European part of the U.S.S.R. near Leningrad, Kirjach of the Ivanovsk region, Sterlitamaksk, and the Chekmagushevsk region of the Bashkirsk A.S.S.R.

2. Forcellinia diamesa, sp.n. (Fig. 169)

This is intermediate between the typical tyroglyphid form - F.fungivora Ouds. and the exceedingly specialised myrmecophilous form - F. was-

manni Moniez.

V e are smooth; both pairs of sc are of almost the same length (approximately 27% of the idiosoma); h i are slightly longer than h e; d_1 is about 15% of the idiosoma in length, widening like a spade towards its end and thickly pectinate at the edges; d_2 and l a are 2 to 2.5 times longer than d_1 and almost equal to d_3, d_4, l p and h i (30 to 35% of the idiosoma); sa e are shorter than the other setae of the hysterosoma (13%); sa i are longer than any of the other setae (about 45% of the idiosoma). All the long setae of the dorsal surface of the hysterosoma are fairly sparsely and thinly pectinate, pliable, not thickened and ending in a narrow, lance-shaped transparent blade; v i and sc are similar in structure but lack the apical blades; the pseudostigmatic organ is slightly toothed.

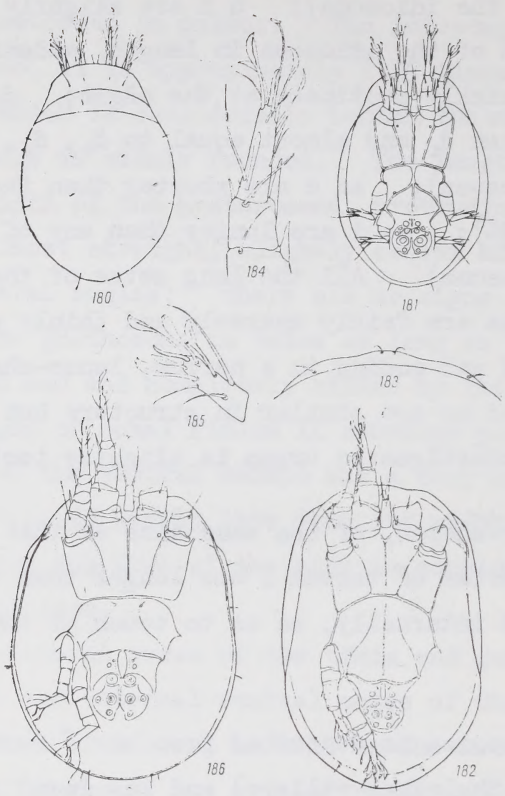
♂. The penis is beak-shaped, of the same size as that of F. wasmanni. The internal ventral setae of tarsus I are longer than the rest and directed obliquely and internally, so as to touch at their ends. Length 550μ.

Distribution. The species is described from one ♂ found in the Kuntzev region of Moscow (Shulginno village) and was found in the rotting oak leaves of a deciduous forest.

3. Forcellinia gigantonympha Vtz. (Figs. 180, 181.)

Vitzthum, 1919, Arch. f. Naturg., LXXXIV, 6: 34, fig. 9 (Tyroglyphus).

This is known only as the hypopus, which is very similar to that of F. fungivora and differs only in its enormous size and in the following details: coxal fields II slightly wider posteriorly, and the corresponding lateral edges of the sternal shield are almost parallel to each other (and to the midline of the body); the posterior edge of the ventral shield is arched; the sucking disc is noticeably wider than its length, situated far from the posterior edge of the body; the



Figs.180 - 186

Fig.180 - Forcellinia gigantonympha Vtz., hypopus, dorsal surface. Fig.181 - Ditto, ventral surface. Fig.182 - Acotyledon volgini, sp.n. hypopus, ventral surface. Fig.183 - A. volgini sp.n., propodosomal shield, dorsal surface. Fig.184 - A. volgini, sp.n., hypopus, distal 3 joints of leg I, dorsal surface. Fig.185 - A. volgini, sp.n., hypopus, tarsus IV, ventral surface. Fig.186 - A. tshernyshevi, sp.n., hypopus, ventral surface.

peripheral suckers are smaller.

The ventro-lateral setae of the genua and tibiae I and II are noticeably longer, as well as the middle dorsal seta of tarsi III and IV; the "sucking" seta has a longer and thinner stalk, with a small oval saucer. All other characters are the same as those of F. fungivora. Length 460μ, width 315μ.

Habitat. It has been described from Germany, near Leipzig, where it was found on an ant of the genus Camponotus.

It seems possible that this species is identical with Garsaultia testudo Ouds. 1916, but the incompleteness of the description leaves this question in doubt.

4. Forcellinia wasmanni Moniez. (Figs. 166 to 168, 170 to 172.)

Moniez, 1892, Rev. biol. Nord. France IV: 387; Berlese, 1897: 108; Kramer, 1899, 140; Michael, 1903: 131, t. XXXVIII (Tyroglyphus); Oudemans, 1924, Entomol. Ber. VI, 231 (Forcellinia). Non Oudemans, 1913, Arch. f. Naturg. LXXIX, 10: 170 to 173, t. XVIII, f. 17 to 18.

Biology. Wasmann, 1897, Zool. Anz. XX, 170 to 173, 346 to 350.

V e are finely toothed; all the other setae of the dorsal surface of the idiosoma are of the same type - considerably flattened, widening towards the end and forming an oval or widely lancet-shaped, transparent plate, with a distinct middle vein and thickly pectinate edge; both pairs of sc are the same length - 20 to 25% of the idiosoma; h i are noticeably longer than h e, but somewhat shorter than sc; d_1 are the shortest of the dorsal setae of the hysterosoma, whose lengths vary from 18 to 30% of the idiosoma (the longest are d_3 and sa i); d_2, d_4 and l p are almost equal in length; the pseudostigmatic organ is slightly toothed.

♂. P_2 is barely longer than p_1 and about one-third of the length of

the thickly pectinate p_3, the length of which is 25 to 28% of the idiosoma; the penis is normal in size and shaped like a beak; the ventral apical setae of tarsus I are not modified. Length 350 to 500μ.

♀. The post-anal setae are smooth, approximately equal to sa i. Length 530 to 700μ.

Hypopus. Pinkish brown in colour. The idiosoma is evenly egg-shaped, 1.5 times longer than its maximum width (which is anterior to the middle point), becoming considerably narrower posteriorly. The propodosomal shield is sickle-shaped and does not overhang the base of the front leg. The rostrum is triangular, small but well-defined and carries terminally a pair of fine setae. The gnathosoma is 3 to 3.5 times longer than its width, with almost parallel sides, its distal half protruding beyond the anterior edge of the idiosoma. Coxal fields II are right angled, with lateral edges which tend to converge posteriorly; the posterior edge of the ventral shield has a wavy outline. The coxal suckers are larger than in other species. The sucking disc is equal in length and breadth, it becomes noticeably more narrow posteriorly; the peripheral suckers are smaller than the central; the distance between the posterior edge of the sucking disc and the posterior edge of the body is equal to half its length.

Practically the whole of the femur, the following 3 segments of leg I, and that part of the leg distal to the middle of the genu of leg II, protrude beyond the edge of the body. The ventro-lateral setae of the genu are of medium length; the external and internal ventral setae of the tarsi are hair-like or barely widened; the "sucking" setae of tarsus I have a wide, but short "saucer", bent at a right angle towards its stalk. Tarsus IV has one lance-shaped, widened apical seta and a toothed basal seta. Length 210 to 260μ. Width 160 to 210μ.

Distribution. Holland, Germany, U.S.S.R.: in the latter it has only been found near Moscow in the Kuntzev region and in the Kalinin district of Velikoluksk.

7. Genus Scatoglyphus Berl.

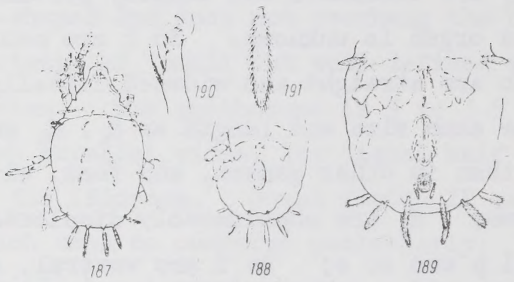
Berlese, 1913, Redia, IX: 104.

Type species: Scatoglyphus polytrematus Berl. 1913.

The chelicerae are fairly slender, not abnormal in size. v e are half as long as v i, placed dorsally, slightly behind a line drawn through the bases of v i, they converge and almost touch at their ends; like the other setae of the idiosoma (except the anal and possibly the sternal), they are thickened and densely pectinate. The structure of Grandjean's organ is unknown. Sc i are considerably shorter than sc e, which are straight and widened distally; h e and h i are short and of the same size and length as d_1, d_3 and l a; d_1 are less widely spaced than in other genera, and form, with d_2 and d_3, regular longitudinal rows; d_4 are considerably displaced posteriorly and are terminal, like l p and sc e; sa i are ventral, situated on the edge of a special fold or projection, and almost completely concealed from above by the overhanging posterior end of the body. Coxal fields III (and possibly I and II) are in the form of shields.

The legs are moderately slender, not long; the surface of the joints of legs I and II (with the exception of the trochanters) are ornamented with branching or + shaped keels; small keels are also present on tibiae III and IV, but absent from other segments of these pairs of legs, the basal setae of genua I and III and the ventral seta of tibia III are thickened like a lancet and are bushy; some of the setae of tarsi I and II (evidently delta, eta and the ventral ones) are also pectinate and considerably longer than usual; the details of the chaetotaxy of the tarsi are not completely clear, but there are no massive conical spines. Sexual dimorphism is slight.

♂. No anal or tarsal suckers; both pairs of anal setae are represented by thin, smooth microsetae; post-anal setae are not shown in Berlese's drawing and may be reduced or absent.



Figs.187 - 191. Scatoglyphus polytrematus Berl. (after Berlese).
Fig.187 - ♂ , dorsal surface. Fig.188 - ♂ , hysterosoma, ventral surface. Fig.189 - ♀ , hysterosoma, ventral surface. Fig.190 - End of tarsus. Fig.191 - A seta of the idiosoma.

♀. The genital opening is very large with a straight posterior edge; the anal slit is close to the genital and far displaced from the posterior edge of the body, on its folds are 5 pairs of thin, smooth long setae, of which the posterior pair is longer than the rest; directly posterior to this pair is a rounded (sclerotised) surface, in the middle of which is the opening to the bursa copulatrix, and from the sides arise a pair of short postanal setae, thickened like lancets; this surface is also remote from the posterior edge of the body. Immature stages are unknown.

1. Scatoglyphus polytrematus Berl. (Figs. 187 to 191.)

Berlese, 1913, Redia IX, 104, t. II, fig. 19.

White, translucent and oval in shape; the setae of the body are thick, fairly short and pectinate, the 6 posterior ones being fairly thick and exceeding the length of the tarsus. The segments of the legs are ornamented with branching folds or wrinkles, their dorsal surfaces bear short setae similar to those described above. ♀. Length 310μ, width 190μ. ♂, 340μ long, 120μ wide.

Distribution. Florence; rare. It lives, with other Tyroglyphidae, in dry chicken droppings.

2. Subfamily Rhizoglyphinae

V e are small microsetae, dorsal in position, arising near the middle of the lateral edges of the propodosomal shield and approximately midway between v i and sc; alternatively, they are absent. Sc e twice as long as sc i, or sc i are absent. The setae of the idiosoma are always smooth, usually short; their bases are often conical or enlarged into bulbs. In Acotyledonini the ends of v i and sometimes of other setae, are slightly toothed. The number of setae tends to be reduced and may result in the loss of whole series of pairs - v e, sc i, h i, s h,

d_1, d_2 and sometimes d_3, 1 a and one pair of sacrals; the setae of the posterior half of the hysterosoma never attain the length characteristic of most Tyroglyphinae, and do not form the bushy, fan-shaped tail which is so characteristic of the latter.

The legs are very different in length and proportion. The apex of the tarsus has a well-developed dorsal conical seta and 5 ventral ones; (only in the genus Thyreophagus are there 2 ventral apical setae and 1 rudimentary one); the longest of the apical setae of tarsi I and II is placed directly by the internal edge of the dorsal apical seta; the internal one to this is short, more or less thickened and often converted into a narrow, laterally compressed plate, which is arched ventrally. Anterior to the main sensory rod alpha, is the auxiliary sensory rod beta which arises from the same segmental cushion; the claws - particularly on the two front pairs of legs - are large and massive; the praetarsus is usually reduced, sometimes very considerably. The medial setae of the tarsi and sometimes also the basal seta of genua I and II, are often converted into more or less strong setae; the setae of the legs are never toothed or pectinate.

Sexual dimorphism is well-defined; in some cases it expresses itself in the great length of legs and idiosoma in the ♂; in others, the ♂ may have an opisthosomal shield covering the posterior part of the dorsal and lateral (sometimes ventral) surfaces of the hysterosoma and forming various, sometimes oddly shaped, plate-like growths; again, it may show in details of the chaetotaxy of the legs, in the general shape of the body, etc. The post-anal setae of the ♂ are often represented by very fine microsetae, and sometimes these are modified; tarsal copulatory suckers are almost always displaced right to the end of the tarsus. The ♀ has one pair of post-anal microsetae, and 0 to 3 pairs of anals and the same number of adanals; the position of the anal slit varies considerably, sometimes being as far from the posterior end of the body as from the genital slit; in other cases, it is so much displaced posteriorly that it extends to the point where the posterior surface of the hysterosoma merges with the dorsal.

A peculiar dimorphism among the males has been observed in many representatives of the subfamily Rhizoglyphinae. In such cases males are represented by two distinct forms - the homeo- and heteromorphic. In the homeomorphic form legs III are normal in size and structure and similar to legs IV, or to the corresponding pair in the females; the setae of the idiosoma and legs are relatively short. In the heteromorphic forms, legs III are modified; they are greatly enlarged, their tarsi shortened and usually fused with a stout claw; one of the ventral setae of the tarsus is also much hypertrophied and shaped like a large spine, forming a kind of chela with the adjacent claw; a praetarsus is completely absent. Correlated with the hypertrophy of the free segments of legs III, their coxal elements are considerably enlarged. In addition, the setae of the idiosoma in these heteromorphic forms are usually longer and thinner than in the homeomorphic ♂, and legs I, II and IV are longer and thinner; also, there may be differences in the general shape of the idiosoma, which may be strikingly decreased in size in the heteromorphic form.

The capability of forming the heteromorphic phases in the ♂ is met with in almost all genera of this subfamily, but usually it arises only in certain species of each genus; in some species, the heteromorphic form is rarely encountered, in others it may be more frequent, and in some colonies all, or almost all, the males may be represented by this form, or lastly the homeomorphic phase may tend to disappear, e.g. a whole series of Schwiebia sp.

The ability to form the motile hypopus is probably characteristic of nearly all species; this is probably correlated with their slight mobility and the feeble power of air dispersal of other developmental stages.

To the subfamily Rhizoglyphinae belong more than 60 species, of which more than 40 are found in the Palearctic; they fall naturally into 2 tribes: Acotyledonini and Rhizoglyphini.

2. Subfamily Rhizoglyphinae

Key to the genera

Males

1(4) V e always distinct, represented by microsetae; sc i, h i, s h, d_1, d_2 and l a well-developed; apical seta of tibia IV normal in structure; sensory club not proximal to a spine (eta is setiform and placed noticeably distal and internal to alpha); posterior end of the body is not modified, without an opisthosomal shield. (Tribe Acotyledonini).

2(3) External ventral and internal setae of tarsi I and II, sometimes even those of tarsi III and IV, curved and diverging, each enlarged distally to form a transparent lobe; ventral setae of tibia spine-shaped, both tarsal suckers placed in the distal part of tarsus IV. Large species (600 to 1200μ).

9. Caloglyphus Berl.

3(2) External ventral seta, as well as all the apical setae of tarsi I and II, simple, fine, not enlarged distally (only the ♂ of A. batsylevi has the external apical seta enlarged into an oval lobe); tarsal copulatory suckers situated in the median part of tarsus IV. Species fairly small (350 to 600μ).

8. Acotyledon Ouds.

4(1) V e absent; sc i, h i, d_1, d_2 (and often also d_3, l a and sa i) often absent; when present, they take the form of microsetae, and immediately in front of the olfactory club is a large spine (the homologue of eta); apical seta of tibia IV in the shape of a conical spine; posterior end of the body usually greatly modified, forming a horizontal sclerotised plate (opisthosomal plate). (2. Tribe Rhizoglyphini)

5(6) Legs IV greatly enlarged; posterior end of body not modified, no opisthosomal plate.

12. Heteroglyphus Foa.

Only one species, insufficiently known, H. vitium Foa, Italy.

6(5) Legs IV not swollen; in cases where they are slightly thickened (as in Histiogaster), there is a well-developed opisthosomal plate bearing 4 transparent lobes like a fan.

7(8) Opisthosomal plate absent, posterior end of body unmodified; p_1 and p_2 long; sc i, h i, d_1 and d_2 represented by microsetae; 2 pairs of sa (sa e and sa i); anal copulatory suckers without a sclerotised ring; external and internal ventral setae, as well as the internal apical seta of tarsi I and II, a little enlarged distally, leaflike.

10. Rhizoglyphus Clap.

Only one cosmopolitan species, R. echinopus F. and R.

8(7) Opisthosomal plate well-developed; p_1, often p_2 as well, represented by microsetae, or else p_2 and p_3 are absent; one pair of sa (sa i); anal suckers encircled by a strongly sclerotised ring; ventral and apical setae of tarsi not enlarged.

9(10) Opisthosomal plate strongly narrowing towards its base, with a festooned edge, bearing 4 transparent lobes arranged like a fan; legs fairly long and thin; legs IV distinctly longer and stouter than legs III, anal suckers entirely sclerotised, very convex; anal setae lanceolate; one pair of postanal setae.

12. Histogaster Berl.

10(9) Opisthosomal plate approximately semi-circular, widening towards its base, with an entire edge, without projections; legs short, normally thick; legs III slightly shorter and thinner than legs IV, or else of the same size; sometimes legs III are strongly

thickened and modified (as in the heteromorphic males); anal suckers only sclerotised as a circle, moderately convex; anal setae not flattened; 3 pairs of post-anal setae.

11(12) A strong conical spine is found immediately in front of the olfactory club; external ventral setae of tibiae and genua I and II as well as 2 of those of the tarsi, represented by more or less conical spines; praetarsus completely absent; opisthosomal shield placed on the same level as the dorsal surface of the hysterosoma and continuous with it; the internal surface of this plate is oblique, so that the suckers on it point backwards (when viewed laterally); males only represented by the heteromorphic form, or else this phase is more numerous than the homeomorphic.

13. Schwiebia Ouds.

12(11) Base of spine much in front of olfactory club; all the setae of tibiae and genua, as well as 2 of the ventral setae of the tarsi, thin and flexible; praetarsus well-developed; males only represented by the homeomorphic phase.

13(14) V i often absent; l a well-developed, fairly long; p_2 long, flexible; sc e and h e shorter (12 to 20% of the length of the idiosoma); praetarsus represented by one or two vertical, semicircular plates, enveloping the sides of the base of the claw; structure of the opisthosomal plate as in Schwiebia.

14. Monieziella Berl.

14(13) V i always well-developed; l a absent; p_2 represented by minute microsetae; sc e and h e long (33 to 40% of the length of the idiosoma); praetarsus shaped like a membranous lobe enveloping the greater part of the claw (as in Tyroglyphinae); opisthosomal plate placed on the same level as the ventral surface of the body; dorsal surface of the hysterosoma abruptly sloping posteri-

orly, forming an oblique surface above the plate (when viewed laterally).

15. Thyreophagus Rond.

Only one species, Th. entomophagus Lab. England, France, Italy, U.S.S.R. (Leningrad, Moscow, Ivanovo, Barnaoul).

Females

1(4) V e represented by very distinct microsetae; sc i, h i, d_1 and d_2 well-developed; no spine anterior to the olfactory club; (eta setiform, placed considerably in front and more internal than alpha); anal opening normally situated in the middle of the opisthosoma, well removed from the posterior end of the body; even when more posterior in position, the distance between its posterior extremity and the posterior edge of the body is not greater than half the distance between its anterior edge and the genital opening; 4 to 6 pairs of anal microsetae (rarely 3 pairs). (1. Tribe Acotyledonini.)

2(3) External ventral seta, as well as the internal apical seta of tarsi I and II, and often of III and IV, strong, stout, arc-shaped and enlarged distally to form a more or less wide transparent lobe; ventral setae of the tibiae shaped like strong conical spines; praetarsus moderately developed, forming a frill around the base of the claw. Species large in size.

9. Caloglyphus Berl.

3(2) All the apical and external ventral setae of tarsi simple, flexible, not expanded distally; praetarsus strongly developed and cushion-like, enveloping all the basal half of the claw. Species smaller in size.

8. Acotyledon Ouds.

4(1) V e absent; sc i, h i, d_1 and d_2 all absent; when present, they are represented by microsetae, and immediately in front of

the sensory rod is found a large conical spine (genus Rhizoglyphus); anal opening more posterior in position, near the posterior edge of the body, sometimes even the anal folds project beyond it; only one pair of anal microsetae, or else these are completely absent. (2.Tribe Rhizoglyphini.)

5(6) Sc i, h i, d_1 and d_2 represented by microsetae; pseudostigmatic organ well-developed, setiform; legs strongly armed with numerous strong spines. Species of large size, very swollen.

10. Rhizoglyphus Clap.

Only 1 cosmopolitan species, R. echinopus F. and R.

6(5) Sc i, h i, the pseudostigmatic organ, d_1 and d_2 absent, also sometimes d_3 and l a. Species of small size (280 to 630μ).

7(10) A conical spine (eta) is found immediately in front of the olfactory club; only one pair of sacral setae; anal microsetae absent; praetarsus strongly reduced or completely absent.

8(9) Sc e, h e, d_4 and sa e very long (30 to 65% of the length of the idiosoma); d_3 15 to 40% of the length of the idiosoma; legs fairly long and thin; external ventral and internal setae of tarsi I and II, long, flexible; apex of genu I with 2 dorsal setae; epimeres III and IV not united.

12. Histogaster Berl.

9(8) Sc e, h e, d_4 and sa e short (7 to 25% of the length of the idiosoma); d_3 and l a absent or represented by microsetae; legs very short (14 to 23% of the length of the idiosoma), strong; internal ventral seta of tarsi I and II spine-like; apex of genu I with 1 dorsal seta; when 2 are present, epimeres III and IV are united at their ends.

13. Schwiebia Ouds.

10(7) No spine anterior to the olfactory club; 2 pairs of sacral

setae (sa e and sa i); one pair of anal microsetae; praetarsus well-developed; idiosoma much elongated (2 to 4 times longer than wide), cylindrical.

11(12) V i often absent; l a well-developed; all the setae of the idiosoma short, fairly stiff; praetarsus represented by 1 or 2 vertical semicircular lobes enveloping the 2 sides of the basal part of the claw; idiosoma extremely narrow, 2 to 3.4 times longer than wide.

14. Monieziella Berl.

12(11) V i well-developed; l a absent; all the setae of the idiosoma very long, thin and flexible; praetarsus shaped like a cushion enveloping the great part of the claw (similar in structure to that of the Tyroglyphinae); idiosoma 2 to 3.2 times longer than wide.

15. Thyreophagus Rond.

Only 1 species, Th. entomophagus Lab. - England, France, Italy, U.S.S.R. (Leningrad, Moscow, Ivanovo, Barnaoul).

3. Tribe Acotyledonini

The chaetotaxy of the dorsal and lateral surfaces of the idiosoma is not reduced and consists of a complete collection of 15 pairs of setae; v e are minute, but always completely developed. The length and proportions of the legs are very variable; the praetarsus is more feebly developed than in the Tyroglyphinae, but is always conspicuous. The apices of the tarsi have well-developed dorsal spines and 5 ventral ones; on tarsus I both basal sensillae are developed and situated near each other in the basal third of the tarsus; sensilla eta is represented by a thin (not spine-like) seta and is considerably anterior to the sensory rod; one of the apical setae (the second internal to the dorsal apical spine) is thickened, but not modified. Sexual dimorphism exists in most forms, but is not very conspicuous; in the ♂ it is shown

by the setae of the idiosoma being longer and the legs longer and more slender; the opisthosomal shield in the ♂ is absent; the apical seta of tibia IV is of normal structure. In the ♂ the anal copulatory suckers are raised and lack a ring-shaped sclerotised frame; there are 3 pairs of well-developed post-anal setae and the tarsal copulatory suckers are in line with one another. In the females the anal opening is in the middle of the opisthosoma, at the same distance from the genital (oviducal) opening and the posterior edge of the body; they have one pair of post-anal setae and 3 to 6 pairs of anal microsetae.

I consider that 2 genera - Caloglyphus Berlese 1923 and Acotyledon Ouds. 1902 - belong to this tribe, containing 22 palearctic and 10 American and Indo-Malayan species. To this group belongs Achropodophorus Rosas Costa 1929.

8. Genus Acotyledon Ouds.

Oudemans 1903, Tijdschr. Entomol., XLV, 147. - Eberhardia Oudemans, 1924, Entomol. Ber., VI, 230; Zachvatkin, 1937, 187; - Cosmoglyphus Oudemans 1932, Entomol. Ber. VIII, No. 183: 358. - Myrmoglyphus Vitzthum, 1935, Zool. Anz. CSII, i.

Type species: Acotyledon paradoxa Ouds. 1903 (hypopus).

Small or average sized forms, ♂ 350 to 600μ, ♀ 450 to 700μ. The shape and proportion of the idiosoma are very varied, as well as the length and proportions of the legs. The external ventral, as well as all the apical setae of tarsi I and II are simple, hair-like, not broadened terminally (except in the heteromorphic ♂ of A. batsylevi, in which one apical seta of tarsi I and II is enlarged into an oval plate); the internal and middle ventral ones are sometimes represented by spines or simple setae.

♂. The tarsal copulatory suckers are placed at approximately the same distance from the base and apex of the joint.

♀. The anal slit (e.g. in A. rhizoglyphoides and A. krameri) is sometimes near the posterior end of the body, but is usually removed from it; 6 pairs of anal microsetae are present. Sexual dimorphism is feebly marked.

Larva. Has well-developed v e, sc i, h i, l a, d_1, d_2, and is easily distinguished from species belonging to the genus Caloglyphus, in which all these setae are vestigial.

Hypopus. This is of two sharply differing types, which were once considered to belong to independent genera (Acotyledon and Cosmoglyphus), but these do not correspond to any definite groupings in the adult stage. The hypopi of Acotyledon are characterised by having an oval idiosoma, with blunt, not flattened edges, and is feebly cuticularised. The dorsal surface is evenly curved and covered with relatively long, thin, hair-like setae. H e is on the same transverse line as h i. The propodosomal shield is triangular, occupying not less than one-quarter of the dorsal surface of the idiosoma; its edges do not widen laterally. The sternal shield is ill-defined, the posterior part of it only feebly indicated by a thin, non-cuticularised fold of the cuticle. The sternum and epimeres II are short, free and do not reach the posterior edge of the sternal shield by quite a large extent; they are arc-shaped. Coxal fields III are closed and are fairly wide apart, coxal fields IV are divided by a space which narrows posteriorly and is feebly indicated. The genital shield is not separate. The surface of all the ventral shields of the idiosoma is feebly cuticularised (almost membranous in consistency), with incompletely defined thickenings of the edges. The coxal suckers are feebly developed or absent. The sucking disc is soft and membranous, strongly extended longitudinally like a tongue or much reduced. It has 1 to 4 pairs of feebly defined, more or less rudimentary suckers.

The legs are of medium size, fairly massive and all of one type. The whole of leg I and that part of II distal to the apex of the femur, can be seen from the dorsal aspect. The setae of the genu and tibia

are needle-shaped; the tarsi have 3 or 4 feebly lance-shaped setae; the anterior tarsi are without a "sucking" seta, its place being taken by a long, simple seta.

The hypopi of the Caloglyphus type are similar to those of Forcellinia. The idiosoma is widely elliptical or almost round, with plate-like flattened edges, in most cases they are coloured and strongly cuticularised. All the setae of the dorsal surface are microsetae. Sc are strong, rather bent, h e are considerably posterior to h i. The propodosomal shield is very short (8 to 30 times shorter than the hysterosomal), plate-like, often with wing-like lateral extensions. The ventral surface is strongly cuticularised; the sternal shield is well-defined, with long, almost straight lateral edges and a concave posterior edge, it is separated from the ventral shield by a thin membranous line. The sternum and epimeres II are thin and very long, and are separated from the posterior edge of the shield by a small distance; they are almost straight, very slightly converging posteriorly. The ventral shield is distinctly separated from the genital; it has an arc-like convex anterior edge, long straight lateral edges (exceeding the length of the acetabular edge) and a wavy posterior edge. The edge of the coxal fields III is half open, epimera III are long, converging anteriorly to form an acute angle and finishing at the ventral setae at some distance from the ventral seam and anterior edge of the shield. Coxal fields IV are narrow, open, separate only at the front; coxal suckers are well-developed (in A. eurynympha the anterior ones are replaced by setae); the sucking disc is rounded and transversely elliptical, strongly cuticularised, with 5 pairs of well-developed suckers, considerably removed from the posterior edge of the body.

Legs I and II are fairly massive, partly hidden under the plate-like edge of the propodosomal shield. The external ventral setae of the tibia and genu are converted into large, dagger-like spines (in A. tshernyshevi they are thinner than in other species); the tarsi are more or less flattened, with 4 to 5 leaf-like setae which are twisted at their ends, and a well-developed "sucking" seta. Legs III and IV are well-

shaped, with long thin tarsi (in preparations, nearly always bent at right angles to the proximal segments of the legs), armed with 3 to 5 leaf-like widened setae which are somewhat twisted at their ends.

To the genus Acotyledon belong, I consider, 12 palearctic species and also the tropical forms - A. dampfi Ouds. 1928, A. leefmansi Ouds. 1927, A. oudemansi A.Z. 1937, A. sironiformis F. and R. 1868.

Acotyledon Ouds.

Males

1(2) Postanal setae arranged in 2 longitudinal rows, the space between p_1 and p_2 is equal, so that the 4 setae are arranged in a square; the distance between the posterior extremity of the anal slit and the posterior end of the body is more than twice the length of the anus; the propodosoma and gnathosoma are very narrow. England.

5. A. michaeli Ouds.

2(1) The postanal setae are differently arranged; p_1 are always wider apart than p_2; the distance between the posterior end of the anal slit and the posterior end of the body is not more than 1.5 times the length of the anus; the proportions of the gnathosoma and propodosoma are normal.

3(8) Sc i 5 to 10 times shorter than sc e; the distance between the sc i is more than twice as great as that between sc i and sc e; the pseudostigmatic organ is setiform, almost smooth; ventral setae of the tarsi not thickened as spines; olfactory club of tarsi I and II club-shaped.

4(5) Sc i 10 times shorter than sc e; they are separated by a distance 6 times greater than that which separates them from sc e; all the setae of the hysterosoma are very short; h e are not greater than 15, d_4, l p and sa i are 5 to 7% of the length of the

idiosoma; tarsi I and II less than twice as long as their diameter. U.S.S.R., Moscow, Kostroma.

1. A. rhizoglyphoides A.Z.

5(4) Sc i 5 to 6 times shorter than sc e; the distance between them is 4 to 4.3 times greater than that which separates them from sc e; some of the setae of the hysterosoma are fairly long, h e being 20 to 30, d_4, 1 p and sa i 15 to 18% of the length of the idiosoma; legs longer and thinner; the length of tarsi I and II is greater than 3 times their diameter in the middle.

6(7) P_2 placed on the same level as p_1, forming a transverse row with them; h e longer, up to 30% of the length of the idiosoma. Legs thin. Italy.

4. A. agilis Can.

7(6) P_2 much more posterior than p_1, almost at the same level as p_3, forming with the latter a slightly arched transverse line; h e shorter, nearly 20% of the length of the idiosoma; legs thicker. U.S.S.R. (Leningrad, Moscow, Eastern Siberia).

2. A. sokolovi sp.n.

8(3) Sc i 2 to 3 times shorter than sc e; the distance between each of sc i is not more than 1.5 times the distance between sc i and sc e; pseudistigmatic organ plumose; sensory club of tarsi I and II not markedly swollen at the end.

9(10) Idiosoma much elongated, almost cylindrical; its length is more than 2.5 times greater than its maximum width; ventral setae of tarsi I and II not spine-shaped. Italy, U.S.S.R. (Odessa region).

8. A. krameri Berl.

10(9) Idiosoma not more than 1.9 times longer than wide; median and external ventral setae of tarsi I and II modified into strong, conical spines.

11(12) Setae of the idiosoma (above all, the shortest of these), straight, rigid, almost pointed; p_2 at the same level as p_3. England.

7. A. alberti A.Z.

12(11) Setae of the idiosoma more or less thin, flexible, not pointed.

13(14) Setae of the idiosoma longer, all very thin and flexible; in the homeomorphic form, the length of d_3 and l p is almost 22, l a 16 to 17% of the length of the idiosoma; p_2 placed on the same level as p_3, 3 times longer than p_1; pseudostigmatic organ thickened, widely lanceolate, bearing several hair-like processes on its dorsal surface; one of the apical setae of tarsi I and II is widened distally, forming an oval, transparent lobe. U.S.S.R., Vorochilovsk (N. Caucasus).

10. A. batsylevi sp.n.

14(13) Setae of the idiosoma shorter; length of d_3 and l p is not greater than 16 to 17, that of l a 9% of the length of the idiosoma; certain setae - d_1, d_2, l a and also sometimes d_3, d_4, l p and h i are obtuse and appear truncate at low magnifications; at higher magnifications, one can see that each is flattened at the end and shaped like a rounded spatula, p_2 considerably anterior to p_3, not more than twice as long as p_1; pseudostigmatic organ only plumose at the edges; heteromorphic stage unknown (without doubt absent). U.S.S.R. (Bachkiria, around Kalinin).

6. A. redikorzevi A.Z.

15(16) Setae of the idiosoma shorter; sc i nearly 10, d_1 and d_2 5.5 to 6.5, l a 14 to 15, sa e 14, sa i 25 to 27% of the length of the idiosoma; pseudostigmatic organ wider and more flattened. U.S.S.R. (Bachkiria).

6a. A. redikorzevi redikorzevi A.Z.

16(15) Setae of the idiosoma longer; sc i 14 to 15, d_1 and d_2 9 to 10, l p nearly 17, sa e 23 to 24, sa i almost 32% of the length of

the idiosoma; pseudostigmatic organ almost cylindrical. U.S.S.R. (around Kalinin).

6b. A. redikorzevi borealis s.sp.n.

Females

1(8) Sc i 6 to 10 times shorter than sc e; the distance between the latter pair is more than twice that between sc e and sc i; ventral setae of tarsi I and II not spine-shaped; pseudostigmatic organ setiform.

2(3) Sc i more than 10 times shorter than sc e, the distance between them is 6 times greater than that between each of them and sc e; all the setae of the hysterosoma very short; d_3 and d_4 5 to 6, l p and sa i nearly 7, h e not more than 15% of the length of the idiosoma; legs short, very strong; tarsi I and II more than twice, tarsus IV nearly 3 times longer than their average diameter; the distance between the posterior end of the anal opening and the posterior end of the body is 2.5 times less than the space which separates it from the genital opening. U.S.S.R. (Moscow, Kostroma).

1. A. rhizoglyphoides A.Z.

3(2) Sc i from 6 to 7 times shorter than sc e; the distance between them is not greater than 4 to 4.3 times that between them and sc e; certain of the hysterosomal setae considerably longer; legs longer and thinner; tarsi I and II not less than twice as long as their diameter in the middle; the distance between the posterior extremity of the anal opening and the posterior edge of the body is more than half that which separates its anterior extremity from the genital opening.

4(5) D_2 3 times longer than d_1, equal to half of d_3 in length, the latter being 25 to 27% of the length of the idiosoma; the space between the anal and genital openings is approximately equal to the distance between the posterior end of the anal opening and the pos-

terior edge of the body; post-anal setae situated well behind the anal opening.

5. A. michaeli Ouds.

5(4) D_2 equal to d_1 in length and 5 times shorter than d_3, or equal in length; in the latter case, they resemble microsetae; the space between the genital and anal openings is 1.7 times greater than the distance between the posterior end of the anal opening and the posterior end of the body; post-anal setae placed a little behind the end of the anal opening.

6(7) D_3 are microsetae, as well as d_1 and d_2; h e and d_4 are almost 30% of the length of the idiosoma.

4. A. agilis Can.

7(6) D_3 5 times longer than d_2, approximately 15% of the idiosoma in length; d_4 and sc i are about the same length (17 to 18%), h e is 20% of the length of the idiosoma. U.S.S.R. (Leningrad, Moscow, Ivanovo, Bachkiria, Eastern Siberia).

2. A. sokolovi sp.n.

8(1) Sc i 2 to 3 times shorter than sc e; the distance between the setae of this pair is more than 1.5 times greater than that which separates them from sc e; ventral setae of tarsi I and II usually spine-like; pseudostigmatic organ plumose.

9(10) Anal opening very near to the posterior edge of the body, idiosoma 2.1 to 2.2 times longer than wide; ventral setae of tarsi I and II fine and pointed; l p 3 times longer than l a. Italy, U.S.S.R. (Odessa region).

8. A. krameri Berl.

10(9) Anal opening very far removed from the posterior end of the body; idiosoma not more than 1.9 times longer than its maximum width; ventral setae of tarsi I and II spine-like, l p not more

than 5 times longer than l a.

11(12) Idiosomal setae straight, pointed, sharp; d_3 short, equal to d_2 in length; d_3 equal to d_4 (12 to 15% of the length of the idiosoma). England.

7. A. alberti A.Z.

12(11) Idiosomal setae felxible, not pointed.

13(14) Idiosomal setae long, very fine; d_3 and d_4 equal to 24 to 25, l p and sa i almost 21 to 23, sa e 17 to 18% of the length of the idiosoma; sc i a little more than twice as short as sc e; pseudostigmatic organ flattened, wide, lanceolate, with several spine-like protrusions arising from the dorsal surface, ventral median and internal setae of tarsi I and II resemble long, thin spines.

10. A. batsylevi sp.n.

14(13) Idiosomal setae shorter: d_3 and d_4 not more than 15 to 16, l p and sa e 10 to 12, sa i 18% of the length of the idiosoma; sc i 3 times shorter than sc e; some of the dorsal setae - d_1, d_2, l a and sometimes even d_3, d_4, l p and h i, blunt at their ends; pseudostigmatic organ narrower, only plumose at the edges; median and internal setae of tarsi I and II resemble short, strong spines. U.S.S.R. (Bachkiria, Kalinin region).

6. A. redikorzevi A.Z.

15(16) Setae of the dorsal surface of the idiosoma shorter; v i 11 to 12, sc e 25 to 27, h e almost 20, d_2 7 to 7.5, d_3 12 to 13, l a 7.5 to 8% of the length of the idiosoma; pseudostigmatic organ wider and more lamelliform. U.S.S.R. (Bachkiria).

6a. A. redikorzevi redikorzevi A.Z.

16(15) Setae of the dorsal surface of the idiosoma longer; v i 13 to 14, sc e 30 to 33, h e almost 25, d_2 10.5 to 11, d_3 15 to 20, l a 11%

of the length of the idiosoma; pseudostigmatic organ narrower, almost cylindrical. U.S.S.R. (region of Kalinin)

6b. A. redikorzevi borealis s.sp.n.

Hypopi

1(8) Propodosomal shield almost triangular, with obtuse borders, not flattened, covering not less than a quarter of the dorsal surface of the idiosoma; ventral shield membranous in consistency, almost non-existent, and bearing then 1 to 2 pairs of rudimentary suckers, or else much elongated, narrow, tongue-shaped, with 4 pairs of more or less rudimentary suckers; coxal fields I and II feebly sclerotised, not forming a well-defined sternal shield; the genital shield is not separated from either coxal fields IV or the ventral shield.

2(5) Ventral shield with 4 pairs of suckers (arranged in the following order: 2, 2, 4), narrow, tongue-shaped, strongly elongated; central and anterior pairs of suckers fairly large, but ill-defined, the posterior ones are all of the same size, and small and clearer; coxal suckers more or less distinct.

3(4) Rostrum sharply pointed; larger in size. U.S.S.R. (Moscow, Leningrad, Ivanovo, Bachkiria, Eastern Siberia).

2. A. sokolovi sp.n.

4(3) Rostrum obtusely rounded; smaller in size. U.S.S.R.(Moscow, Kostroma, Jitomir).

1. A. rhizoglyphoides A.Z.

5(2) Ventral shield rudimentary, with 2 pairs of more or less distinct suckers; coxal suckers absent.

6(7) Ano-genital opening very long, flanked behind the middle by one pair of fairly well-developed suckers; the second pair, quite rudimentary, is a little behind the first pair and is only repre-

sented by double pores, situated very close together; epimerites II barely visible; the sternum is far from reaching the ends of epimeres II. U.S.S.R. (Kiev, Irkutsk).

3. A. paradoxa Ouds.

7(6) Genital opening short, not united with the anal; the two pairs of suckers are placed considerably nearer to the posterior edge of the body, the suckers of the first pair are wider apart than those of the posterior pair, but have the same shape and size; epimerites II fairly well marked; sternum long, extending almost to the same level as epimeres II. England.

5. A. michaeli Ouds.

8(1) Propodosomal shield of a different shape, with flattened edges (lamellate) concealing the base and greater part of legs I and II; its length is not more than one-eighth that of the idiosoma; ventral shield normal in structure, strongly sclerotised, rounded or transversely elliptical, with 4 pairs of well-developed suckers: coxal fields I and II equally well sclerotised, forming a strong, very distinct, sternal shield; coxal fields III open, when shut, they are very wide apart; genital shield distinctly outlined, separated from the ventral shield and sucking disc.

9(10) Peripheral setae of the hysterosoma (above all h i, h e, sa i and p a) strong, spine-shaped. England.

7. A. alberti A.Z.

10(9) Peripheral setae of the hysterosoma very thin and flexible.

11(14) Anterior border of propodosomal shield almost straight, feebly curved, with a feeble median lobe and slight lateral depressions; rostrum displaced on to the ventral surface of the shield and completely covered by its edge, sometimes absent; gnathosoma with

parallel or feebly converging posterior edges.

12(13) A large species (380μ), dark in colour; propodosomal shield extremely short, 35 times shorter than the hysterosoma; ventral shield considerably longer than the sternal, crossed longitudinally by a ventral groove; coxal fields more or less half open; legs I and II short and thick, more than half hidden by the propodosomal shield; external setae of tibiae and genua I and II strong and knife-shaped. U.S.S.R. (Bachkiria).

11. A. volgini sp.n.

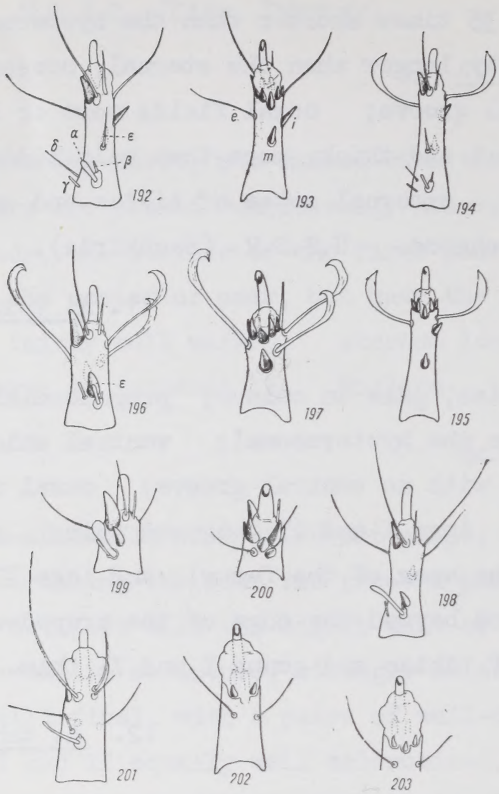
13(12) A small species, pale in colour; propodosomal shield only 8 times shorter than the hysterosomal; ventral shield much shorter than the sternal, with no ventral groove; coxal fields II shut, very wide apart; legs I and II long and thin; the distal part of legs I (from the apex of the femur), and legs II (from the apex of the genu) extend beyond the edge of the propodosomal shield; external spines of tibiae and genua I and II thin. U.S.S.R. (Odessa region).

12. A. tshernyshevi sp.n.

14(11) Anterior edge of propodosomal shield deeply concave on either side of the rostrum; this is marked, triangular in shape, having on its apex 2 well-developed setae; the ventro-lateral setae of tibiae and genua I and II large, knife-shaped; gnathosoma pear-shaped, not more than twice as long as wide, deeply cleft to its base; coxal fields III open, epimeres IV free.

15(16) Rostrum fairly wide, shorter than the lateral lobes of the propodosomal shield, which are right angled and only rounded at their apices; the distance between the posterior edge of the ventral shield and the posterior edge of the idiosoma is the same length as the sternal shield. Italy, U.S.S.R. (Odessa region).

8. A. krameri Berl.



Figs.192 - 203. Tarsi I of the Tyroglyphidae.
Fig.192 - Acotyledon redikorzevi A.Z., tarsus I, ♂, dorsal view. Fig.193 - Ditto, ventral view. Fig.194 - Caloglyphus rodionovi A.Z., tarsus I, heteromorphic ♂, ventral view. Fig.195 - Ditto, ventral surface. Fig.196 - Rhizoglyphus echinopus F and R, tarsus I, heteromorphic ♂, dorsal view. Fig.197 - Ditto, ventral view. Fig.198 - Histiogaster bacchus sp.n., tarsus I, ♂, dorsal view. Fig.199 - Schwiebia rossica, sp.n., tarsus I, ♀, dorsal view. Fig.200 - Ditto, ventral view. Fig.201 - Thyreophagus entomophagus Lab., tarsus I, ♀, dorsal view. Fig.202 - Th. entomophagus Lab., tarsus I, ventral view. Fig.203 - Th. entomophagus Lab., end of tarsus I, ♀, ventral view.

16(15) Rostrum longer than the lateral lobes of the propodosomal shield, which are strongly rounded, so as to be almost semicircular; this rostrum is shaped like a narrow, very distinct protrusion; the distance between the posterior edge of the ventral shield and that of the idiosoma is smaller than the length of the sternal shield. U.S.S.R. (Bachkiria, Kalinin region).

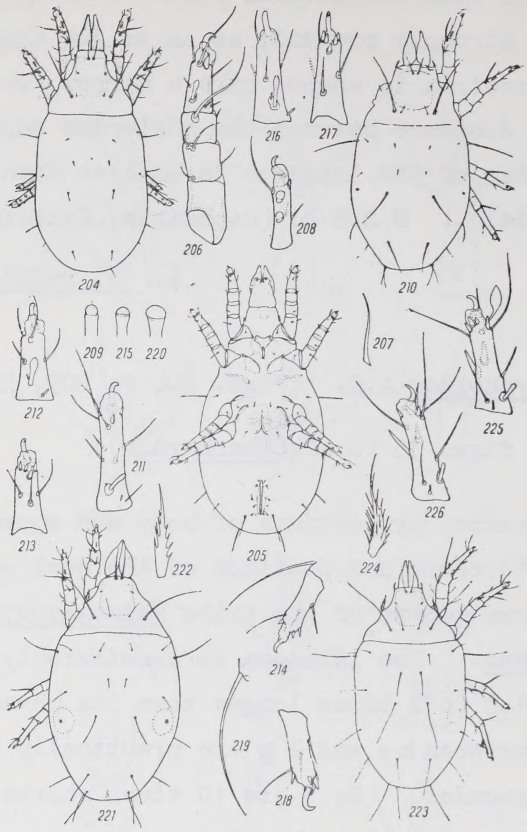
6. A. redikorzevi A.Z.

1. Acotyledon rhizoglyphoides A.Z. (Figs. 204 to 209, 242.)

Zachvatkin, 1937, 191, figs. 35 to 42 (Eberhardia).

Its general appearance, proportions of body and appendages, the short setae of the hysterosoma and position of the anal opening in the ♀ are reminiscent of some genera of the tribe Rhizoglyphini, e.g. Schwiebia or Rhizoglyphus. The idiosoma is considerably elongated and cylindrical in shape, 1.8 to 2 times longer than its maximum width. The sides of the body between h e and l p are practically parallel, the posterior edge widely rounded. Sc i are 10 times shorter than sc e, their bases close together, so that the distance between the two internal setae is 6 times greater than that between sc i and sc e, the latter are much longer than any of the other setae of the idiosoma, about 25% of its length. The setae of the hysterosoma are extremely short, thin and flexible, their lengths - expressed as percentages of the total length of the idiosoma - are as follows: h e 14.8 to 15, h i, d_1, d_2, l a and sa e 2.4 to 2.5, d_3, d_4, l p and sa i 5 to 6.5; there is no noticeable difference in setal length between the two sexes. Sc e and the longer hysterosomal setae are slightly thickened towards the base. The pseudostigmatic organ is shaped like a bristle, smooth and curved like an S.

The legs are relatively short and massive - 28, 26, 21 and 24% of the length of the idiosoma. Tarsi I and II are twice, tarsi IV 2.8 to 3 times longer than their diameter near the middle. The ventral setae



Figs. 204 - 226

Fig.204 - Acotyledon rhizoglyphoides, A.Z., ♂ , dorsal surface. Fig.205 - A. rhizoglyphoides A.Z., ♀, ventral surface. Fig.206 - A. rhizoglyphoides A.Z., ♀, leg I, dorsal view. Fig.207 - A. rhizoglyphoides A.Z., pseudostigmatic organ. Fig.208 - A. rhizoglyphoides A.Z., tarsus IV, ♂ . Fig.209 - A. rhizoglyphoides A.Z. genital 'suckers' of protonymph. Fig.210 - A. sokolovi, sp.n., ♂ , dorsal surface. Fig.211 - A. sokolovi, sp.n., tarsus I, ♀, dorsal view. Fig.212 - A. sokolovi, sp.n., tarsus I, protonymph, dorsal view. Fig.213 - Ditto, ventral view. Fig.214 - A. sokolovi, sp.n., tarsus and apical seta of leg IV of protonymph. Fig.215 - A. sololovi, sp.n., genital 'suckers' of protonymph. Fig.216 - A. paradoxa Ouds., tarsus I of protonymph, dorsal view. Fig.217 - Ditto, ventral surface. Fig.218 - A. paradoxa Ouds., tarsus IV, lateral view. Fig. 219 - A. paradoxa Ouds., apical seta of tibia IV. Fig.220 - A. paradoxa Ouds., genital 'suckers'. Fig.221 - A. redikorzevi A.Z., ♀, dorsal surface. Fig.222 - A. redikorzevi A.Z., pseudostigmatic organ. Fig.223 - A. batsylevi, sp.n., ♀, dorsal surface. Fig.224 - A. batsylevi, sp.n., pseudostigmatic organ. Fig.225 - A. batsylevi, sp.n., tarsus I, heteromorphic ♂ , dorsal surface. Fig.226 - A. batsylevi sp.n., ♀, tarsus I, dorsal surface.

of the tarsi are straight, hard, not thickened; the sensory clubs of tarsi I and II are slender, with almost spherical well-defined ends.

♂. P_2 are on the same level as p_3, forming with them a straight transverse row. The distance between the p_1 setae is approximately equal to that between the setae of the pair p_3. The anal slit is separated from the posterior edge of the body by a distance slightly greater than its length. The distal part of the penis is short and slightly bent. Length 360 to 653μ.

♀. The postanal setae are on the same level as the posterior end of the anal slit, the latter is considerably displaced caudally, so that the distance between its anterior end and the genital slit is 2.5 times greater than the distance between its posterior end and the back edge of the body. Length 535 to 755μ.

Hypopus. This is of the Acotyledon type. It is whitish in colour, with a fairly intense grey-brown tint. The setae of the dorsal surface are thin, hair-like and fairly short. The anterior lateral edges of the propodosomal shield are noticeably concave and the rostrum is rounded. The length of the sternum is less than half that of the propodosoma. Epimera II are directed towards each other at a right angle, are slightly arched and have narrow apodemes; epimerites II are weakly developed, but still visible, making the trapezoid contours of the sternal shield. Coxal fields III are longer than their width, their segmented edges (directed towards the trochanter) are concavely arched. The coxal suckers are reduced and take the form of several cuticularised flat plates; the genital suckers are small, but quite visible. The sucking disc is only slightly sclerotised, and greatly elongated, its suckers being placed in 3 vertical rows 2: 2: 4. The anterior and central suckers are fairly large, with visible ring-shaped central pores and reduced peripheral parts. The lateral and posterior peripheral suckers are small, placed near to one another in a straight transverse row; they are more clearly raised from the surface and more strongly sclerotised

than the others. The genital slit is normal in size and well-separated from the anal. The sensilla delta of tarsus I is bristle-like, the internal ventral seta of tibiae I and II and the ventral seta of tarsus IV are fairly long, resembling needles. Length 210 to 250μ. Width 123 to 145μ.

Habitat. It has only been found in Moscow and Kostroma.

Ecology. It was found in old, more or less mildewed grain, wheat and flax in granaries, particularly under thin floors.

2. Acotyledon sokolovi sp.n. (Figs. 210 to 215.)

Sc i 6 to 6.4 times shorter than sc e; the distance between the two setae sc i is 4.5 times greater than that which separates them from sc e; the latter are considerably longer (30 to 31%) than all the other setae of the idiosoma. The setae of the hysterosoma are, generally speaking, short - h i, d_1, d_2 and l a are microsetae 2.5 to 3.3%; h e is 20, d_3 15, d_4 17 to 20, l p 15 to 16, sa e 5 to 6, sa i 17 to 18% of the length of the idiosoma; h i, d_1, d_2, l a and sa e are characteristically short, whilst l p is relatively long - 5 to 5.5 times longer than l a; the longer setae have bulbous bases, the smaller ones are thin and flexible; the pseudostigmatic organ resembles a bristle. The legs are of average length; all the ventral setae of the tarsus are fairly long, thin and flexible, not thickened into spines. The sensory club of tarsi I and II is thick, with a moderately well-defined, egg-shaped end.

♂. Homeomorphic form. There is no difference in setal length between ♂ and ♀. P_1 are placed almost as far apart as p_3, p_2 are almost on the same level as p_3, and with them form a feebly arched, transverse row. P_2 are considerably wider apart than in other species, the distance between them being slightly more than twice that between p_1. The anal slit is far removed from the posterior edge of the body, this distance

being equal to 1.5 to 1.75 the length of the anus. The legs are slightly shorter than in the ♀. Length 600 to 655μ.

♀. At its posterior edge, the idiosoma is wider than in the ♂, some individuals being pear-shaped and distended with eggs. The distance between the genital and anal slits is almost twice the distance between the posterior end of the anus and the posterior edge of the body. The legs are slightly longer than in the ♂. Tarsus IV is noticeably longer than the tibia and genu taken together. Length 550 to 740μ.

Hypopus. This is very similar to the hypopus of A. rhizoglyphoides, but is larger. Length 300 to 350μ, width 210 to 295μ. It has a narrower, finely sharpened rostral prolongation.

Habitat. Suburbs of Leningrad, Moscow, the Ivanovsk district, etc.

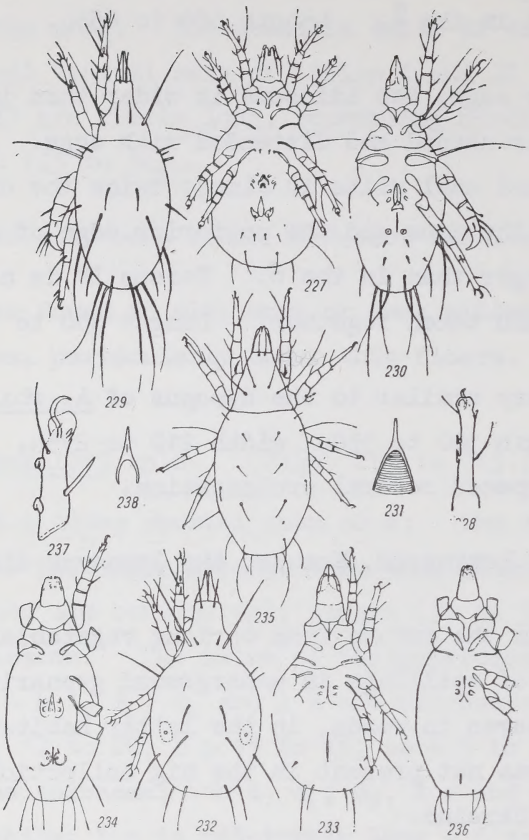
Ecology. It lives in the refuse from various vegetables, in rye or grain, and in layers of spillings in underground granaries, in damp seeds and layers of dead leaves in woods, in the latter habitat it was found near Moscow, but it was not present in the big collections of Acari made by Chernishov in the Ukraine.

3. Acotyledon paradoxa Ouds. (Figs. 216 to 220, 239 to 241.)

Oudemans, 1902, Entomol. Ber., 1: 44; Tijdsch. Entomol., XLV, 147, t.12, figs. 48 to 49.

Only the protonymph and hypopus of this species have been described.

Protonymph. This closely resembles that of A. sokolovi and is distinguished from it by a number of small characters - (1) the tarsi are longer and more slender, their length is 3.1 to 3.2 times greater than their diameter in the middle; (2) the ventral setae of the majority of the leg segments are, to a certain extent, longer, considerably thicker, straight, needle-shaped, sometimes spine-like, e.g. the ventral setae of tarsi III



Figs. 227 - 238

Fig.227 - Acotyledon agilis Can. ♂ , ventral surface, (after Canestrini). Fig.228 - A. agilis Can., tarsus IV, ♂ , (after Canestrini). Fig.229 - A. michaeli Ouds., heteromorphic ♂ , dorsal surface (after Michael). Fig.230 - Ditto, ventral surface, (after Michael). Fig.231 - A. michaeli Ouds., penis (after Michael). Fig.232 - A. michaeli Ouds., ♀, dorsal surface (after Michael). Fig.233 - Ditto, ventral surface (after Michael). Fig. 234 - A. krameri Berl., ♂ , ventral surface (after Berlese). Fig. 235 - A. krameri Berl., ♀, dorsal surface (after Berlese). Fig.236 - Ditto, ventral surface (after Berlese). Fig.237 - A. krameri Berl., tarsus IV, ♂ , (after Berlese). Fig.238 - A. krameri Berl., penis (after Berlese).

and IV; (3) the middle ventral setae of tarsus I are placed considerably closer to the base of the tarsus than to the posterior edge of the apical middle spine; the distance between the anterior middle spine and the lateral ventral setae is fairly great (greater than half the diameter of the tarsus); (4) the sensory club of tarsi I and II is slenderer; (5) the distal seta of tibia III is very long, twice as long as tarsus III; (6) the genital sucker is larger, and considerably widened towards its end, the diameter of its hemispherical apex being 9μ.

It differs from the protonymphs of a closely allied species - A. rhizoglyphoides - in having (1) considerably longer setae on the idiosoma and legs, (2) longer and more slender legs (in the protonymph of A. rhizoglyphoides, tarsi I are less than twice as long as their diameter), (3) the sensory club of tarsi I and II is egg-shaped (in A.rhizoglyphoides it is almost round), (4) the position of sc, and (5) the genital suckers are larger and wider (their diameter in A. rhizoglyphoides is 3.5μ and their shape is practically cylindrical).

Hypopus. This is of the Acotyledon type. It is whitish in colour. The anterior lateral edges of the propodosomal shield are straight or slightly concave, the rostrum is blunt, the posterior edge of the hysterosoma widely rounded; the setae of the dorsal surface are fairly long, very fine and resemble hairs. The sternum is longer than half the propodosoma. Epimera II are directed towards each other at an obtuse angle, they are very bent, with very wide apodemes; epimeres II are indistinct. The sternal shield is outlined posteriorly by an arch-shaped transverse line (fold of cuticle). Coxal fields III are short, their free-edges (i.e. those facing the base of the legs) are wavy; coxal fields IV are similar to coxal fields III. Sternal and genital suckers are absent. The sucking disc is a soft, membranous cushion, not separated from the ventro-genital shield, but fairly clearly outlined posteriorly and laterally by a thin fold of cuticle. Only two pairs of much reduced suckers are present, of which the anterior ones (corresponding to the anterior peripheral suckers of the hypopi of other

species) are clearly defined, whilst the posterior ones (homologous with the central suckers) are represented only by double central pores, which can only be seen in the well-illuminated preparations. Both these pairs of suckers are placed close to a long ano-genital slit. The structure and chaetotaxy of the legs is the same as that of A.rhizoglyphoides, but the sensilla eta of tarsi I and II is bigger and shaped like a spine. The internal ventral seta of the tibiae of the same legs and the basal seta of tarsus IV is shorter and thicker, the ventral setae of femur I are considerably longer. Length 244 to 285μ. Width 160 to 195μ.

Habitat. It was found in Russia, but the district has not been recorded. I have only found it in Irkutsk (Siberia).

Ecology. The hypopi described by Oudemans were found on an unnamed bat. The hypopi and emerging protonymphs from Irkutsk were found mainly in wheat and granaries.

4. Acotyledon agilis Can. (Figs. 227, 228.)

Canestrini, 1888, 30, t. 1, figs. 11 to 13; 1888a, 408, t. 33, fig. 2; Kramer, 1899, 139 (Tyroglyphus); Zachvatkin, 1937, 193 (Eberhardia).

I have not found this myself. According to the description and drawings of Canestrini, this species is very similar to A. sokolovi, the only difference is that in the ♂, p_2 are on a level with p_1, forming with them a straight transverse row, and d_3 are microsetae (in fig. 2A of Canestrini's paper, they are not drawn, whilst d_1, d_2 and l a are represented by microsetae). In addition to these characters, the legs are considerably longer and thinner than in A. sokolovi. Judging by Canestrini's figure (2A), the legs in the ♂ are 36, 32, 30, 32% of the length of the idiosoma. Finally, the distal part of the penis is represented as being more sharply bent than in A. sokolovi. All the other characters are similar to those of A. sokolovi. ♀ length 650μ, width 390μ.

The size of the ♂ is not given.

Hypopus. Unknown.

Larva. Dimensions 200 x 110μ, with long slender "bruststiele" which are thickened distally. The postanal setae are longer than sa i, which are very short.

Eggs. These are widely elliptical, as in A. rhizoglyphoides and other closely related species. Dimensions 110 x 80μ.

Habitat. This has only been found in Italy, where it occurred on decomposing plant material.

5. Acotyledon michaeli Ouds. (Figs. 229 to 233, 353.)

Oudemans, 1924, Entomol. Ber., VI, 267 (Tyroglyphus). - agilis, Michael, 1903, 95, t. XXXII, XXVI, figs. 1 to 7 (Rhizoglyphus); Oudemans, 1924, Entomol. Ber., VI, 230 (Eberhardia); 1932, ibid., VIII, 358 (Cosmoglyphus); - michaeli, Zachvatkin, 1937, 188 (Eberhardia).

This is the type species of Eberhardia Ouds. 1923. I have not found it, but on the basis of the original description and Michael's numerous drawings, it can be characterised as follows:-

♂. Heteromorphic phase. The idiosoma is narrow and considerably elongated, the relation of length to width is 2.2:1. Its greatest width is at a level with l a, from which it narrows to sa e; the posterior end is slightly truncate. The gnathosoma is also very long and narrow. Sc i are 3 times shorter than sc e, separated (judging by Plate XXXII, fig. 1 of Michael) by an equal distance from each other and from sc e; the latter is 40% of the length of the idiosoma. Most of the setae of the hysterosoma are very long, probably slightly thickened at the base; their lengths, expressed as a percentage of the idiosoma are as follows:- h i, d_2, l a and sa e - about 14 to 15%, h e, d_3, l p - 40%,

d_4 about 60%, sa i 48%, d_1 - not shown in the drawing, is evidently represented by microsetae. The pseudostigmatic organ is not shown and is not mentioned in the text. The anal slit is far removed from the posterior edge of the body, it is separated from it by a distance greater than twice its length. The postanal setae are placed in 2 longitudinal rows. The distance between each of the 2 pairs of postanal setae - p_1 and p_2 - is the same, their bases forming a square; both these 2 pairs of setae are very short, like spines, about 10 times shorter than p_3. The distal part of the penis is prolonged into a long, thin point.

The legs, except for the modified third pair, are very much longer and thinner, comprising (according to Plate XXXII, fig. 1) 42, 40, 38, 52% of the length of the idiosoma. Tarsi I and II are about 5 times, IV about 7 times longer than their diameter in the middle (Plate XXVI, figs. 3, 4, 6). The ventral setae of the tarsus are strong, straight and pointed, not shaped like conical spines - a fact which is pointed out by the author. The position of the tarsal suckers of the ♂ is not shown, Michael even denies their existence. Length of the idiosoma 570μ, width 280μ.

♂. Homeomorphic phase. Unfortunately this is not described by Michael, he only states that it exists, as well as the heteromorphic one.

♀. This usually differs from the ♂. The idiosoma is considerably wider, about 1.65 times its maximum width, with strongly arched convex sides to the body and an almost straight posterior edge. The gnathosoma is normal in width. Sc i is 6 times shorter than sc e; the distance between the pair of sc i is 3 times greater than that between sc i and sc e, the latter are considerably longer than all the other setae of the idiosoma, about 36% of its length. The setae of the hysterosoma are moderate in length, strong and stiff, their lengths calculated from fig. 3 of plate XXII, and expressed as percentages of the idiosoma are: h i 7.5, h e about 25, d_1 4.5, d_2 13.5, d_3 27, d_4 21.5, l p 23 (l a is not shown in the drawing, it is probably very short and thin), sa e 6,

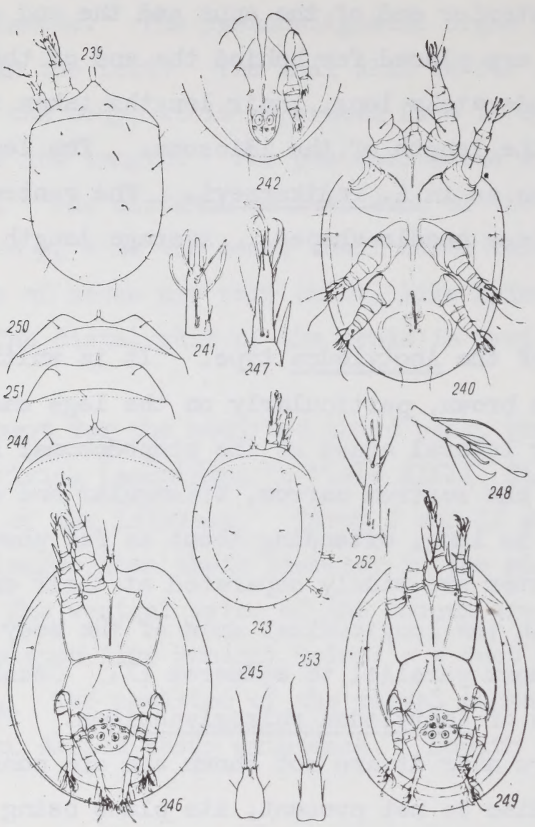
sa i 21. The distance between the anal and genital slit is equal to that between the posterior end of the anus and the end of the body. The post-anal setae are placed far behind the end of the anal slit.

The legs are moderately long, their lengths taken from fig. 4 are 39, 36, 30, 33% of the length of the idiosoma. The length of the tarsus is about the same as in A. redikorzevi. The ventral setae of the tarsus are more or less needle-shaped. Average length of idiosoma - 530μ, width - 320μ.

Hypopus. This is of the Acotyledon type. It is whitish in colour, slightly tinged with brown, particularly on the legs and sides of the body. The anterior lateral edges of the propodosomal shield are noticeably concave, the rostrum narrow, triangular and with a sharp apex. The sternum is long, extending about as far posteriorly as epimeres II, the latter are widely separated at their ends and form a very sharp angle with the longitudinal axis of the body. Epimerites II are distinct, almost parallel to epimeres II. Coxal fields III are similar to those of Acotyledon rhizoglyphoides. The genital slit is short, the suckers near it are not shown and are possibly absent. A distinct sucking disc is not present, its place being taken by 2 widely separated pairs of small suckers, the anterior ones of which are widely separated and lateral (they correspond to the external peripheral) and the posterior ones (homologous with the posterior peripheral) are close together. In addition, external to the suckers of the anterior pair and almost at the e dge of the body, there is a pair of oval bodies whose structure is not clear; Michael calls them a third pair of suckers, but their position makes this doubtful.

The length and proportions of the legs are similar to A. paradoxa and A. rhizoglyphoides; there are no long setae on the tarsus. In other characters, it resembles the afore-mentioned species. Length 260μ, width 160μ.

Habitat. It has only been recorded from England, where it was found on decaying cabbage stems.



Figs.239 - 253. Hypopi of the genus Acotyledon Ouds.

Fig.239 - A. paradoxa Ouds., dorsal surface. Fig.240 - Ditto, ventral surface. Fig.241 - A. paradoxa Ouds., tarsus I, dorsal view. Fig. 242 - A. rhizoglyphoides A.Z., posterior part of hysterosoma with sucking disc, ventral view. Fig.243 - A. redikorzevi A.Z., dorsal surface. Fig.244 - A. redikorzevi A.Z., dorsal view of propodosomal shield. Fig.245 - A. redikorzevi A.Z., gnathosoma, ventral view. Fig. 246 - A. redikorzevi A.Z., ventral surface. Fig.247 - A. redikorzevi, A.Z., leg I, dorsal view. Fig.248 - A. redikorzevi A.Z., tarsus IV, ventral view. Fig.249 - A. krameri Berl., ventral surface. Fig.250 - A. krameri Berl., propodosomal shield, dorsal surface. Fig.251 - A. tshernyshevi, sp.n., propodosomal shield, dorsal view. Fig.252 - A. tshernyshevi, sp.n., leg I, dorsal view. Fig.253 - A. tshernyshevi, sp.n., gnathosoma.

6. Acotyledon redikorzevi A.Z. (Figs. 192, 193, 221, 222, 243 to 248) Zachvatkin, 1937, 192, figs. 33 to 34, 43 to 49 (Eberhardia).

The idiosoma is 1.7 to 1.9 times longer than its maximum width. Sc i are 2.2 to 3 times shorter than sc e, the distance between them is only 1.5 times greater than the distance separating them from sc e, the latter are 25 to 33% of the length of the idiosoma. The setae of the hysterosoma are moderate in length, fairly thin, flexible, not pointed; their lengths expressed as percentages of the idiosoma are: h e 20 to 25, h i 5 to 8, d_1 5 to 9.5, d_2 7 to 10.5, d_3 12 to 20, d_4 12 to 22, l a 7.5 to 11, l p 9 to 17, sa e 9 to 24, sa i 12 to 32. Thus d_1 and d_2 are almost equal in length, while d_3 is not more than twice as long as d_2; l p is 1.2 to 1.6 times greater than l a. Some of the shorter setae of the dorsal side of the hysterosoma have flattened rounded ends, almost as if broken when viewed under the low power. The pseudostigmatic organ is shaped like a scalpel and very pectinate at the edges.

The legs are long and slender; on tarsi I and II, the middle and internal ventral setae are thick conical spines, the ventral setae of tarsi III and IV are also spines. The sensory rod of tarsi I and II is slightly club-shaped at the end, otherwise it is almost cylindrical.

♂. Homeomorphic form. Posterior to l p, the idiosoma is slightly narrower. The dorsal setae are slightly longer than in the ♀, the chief differences being in the lengths of l p, sa e and sa i. The postanal setae are thin and hair-like, p_1 and p_3 are wide apart, whilst the distance between the p_2 setae is 3.5 times shorter, they are about midway between p_1 and p_3, and are 1.7 to 2.2 times longer than p_1. The anal opening is placed at a distance from the posterior edge of the body which is 1.5 times greater than its length. The penis is slightly bent distally.

The legs are much longer than those of the ♀, their lengths are 36 to 39, 33 to 37, 38 to 44% of the idiosoma. Tarsus IV is considerably shorter than the 2 preceding segments of the legs; section ab is 1.5

times greater than cd and ef, which are equal to each other. Length 430 to 516μ.

♂. Heteromorphic form. This is unknown. In the 2 colonies which I investigated, the males were only represented by the homeomorphic form.

♀. The idiosoma is considerably narrower behind 1 p. The setae of the body between the insertions of 1 p and sa e are practically parallel, but behind sa i they converge. The dorsal setae are slightly shorter. The postanal setae arise considerably posterior to the end of the anal slit. The distance between the genital and anal slit is less than that between the hind end of the anus and the posterior end of the body.

The legs are 30 to 33, 29 to 32, 27 to 32, 32 to 38% of the length of the idiosoma. Tarsus IV is equal in length to the 2 preceding joints. Length 530 to 775μ.

Hypopus. This is of the Cosmoglyphus type. In microscopical preparations it is intensely rust-brown in colour, but it appears darker when alive. The surface of the idiosoma is very shiny, as if lacquered. The idiosoma is widely oval, sometimes almost round; the ratio of its length to width varies with the degree of flattening of the edges - from 5 to 4, or 11 to 10. The hysterosoma has disc-like flattened edges. The setae of the dorsal surface are, on an average, equal in length to tibia I, somewhat curved and bent. The anterior edge of the propodosomal shield is strongly arched and incised on either side of the triangular rostrum, from the apex of which arise the well-developed v i; its wing-shaped lateral edges are fairly widely rounded. The rostrum is prolonged into a thin appendix and protrudes beyond a line drawn through the apices of the side flanges. The gnathosoma is pear-shaped, not more than twice as long as wide, its distal end is deeply split into 2 segments. The arist is bent externally in the form of an arc. Epimeres II do not reach the posterior edge of the sternal shield and they do not join epimerites II. Coxal fields III are open; epimeres IV are free and fairly sharply curved. The distance between the

posterior end of the sucking disc and the posterior edge of the idiosoma is less than the length of the sternal shield. The peripheral suckers lie close to the central ones, the anterior ones are slightly smaller than the central and much larger than the posterior and lateral ones, which are of equal size. The lateral suckers are on the same transverse line as the middle pores of the central ones.

The legs are fairly long and slender. The distal part of the femur I and succeeding segments protrude beyond the excised anterior edges of the propodosomal shield; the end of genu II and the succeeding leg segments extend beyond the apex of the lateral flanges of the shield. Tarsi I and II are noticeably flattened in the dorso-ventral plane. The ventral setae of trochanter I are of medium length, the external ventro-lateral spines of the genua and tibiae of legs I and II are very large, flattened, dagger-shaped and slightly bent. On tarsus I sensilla delta is a long, strong seta inserted at approximately the same level as the sensory club alpha. Sensilla eta is a similar, long seta, but it is considerably more distal in position. All the preapical sensillae are like bristles, two of the apical ones are broadened and resemble leaves, which are slightly curved at their ends. The sucking seta has a long, thin stem and a narrow, clearly-defined "saucer". Tarsus II has 2 leaf-shaped setae; on tarsi III and IV there are 4 oval setae, excluding the dorsal apical seta which terminates in an oval plate. Length 252 to 308μ, width 205 to 262μ.

Habitat. It has only been found in 3 places in Asiatic Russia, in granaries. The differences between specimens from 2 localities have obliged me to make 2 new subspecies - A. redikorzevi redikorzevi and A. redikorzevi borealis. They live in large numbers in and around damp germinating seed, present in the sweepings from granaries.

6a. A. redikorzevi redikorzevi A.Z.

The setae of the idiosoma are shorter, and this can be easily seen when the average lengths of the 2 subspecies are compared, their lengths,

expressed as a percentage of the idiosoma, are shown in the following table:

		vi	sc e	sc i	he	hi	d_1	d_2	d_3	d_4	la	lp	sa e	sa i
♂	A.r. redikorzevi	12.5	27	10	21.5	7	6.5	7.5	14.5	20	8.5	14	14.5	27.5
	A.r. borealis	14.4	30	13.5	25	8	9.5	9.5	16	22	10	17	24	32
♀	A.r. redikorzevi	11.5	26.5	8.5	22.5	6	5.5	7	12.5	13.5	7.7	9.5	9.8	16.2
	A.r.borealis	13.7	31.5	11.7	25	8	8	10.7	17.5	16	11	12	12.5	19

The pseudostigmatic organ is fairly broad and flattened. The legs are shorter than in the following subspecies, their lengths in the ♂ being 36, 33 to 34, 32 to 33, 38% of the length of the idiosoma. In the ♀ 30, 29, 27 and 32%.

Hypopus. This is a dark russet-brown in colour. The lateral flanges of the propodosomal shield are widely rounded and have an arch-like protruding edge, which is almost semicircular. The average length (of 10 individuals) was 263μ.

Habitat. Suburbs of the town of Strlitamak , Bashkiria, A.S.S.R.

6b. A. redikorzevi borealis s.sp.n.

The setae of the idiosoma are noticeably longer. The pseudostigmatic organ is slightly flattened, almost cylindrical. The legs are considerably longer than in the typical form - in the ♂ 39, 37, 36.5, 44% of the length of the idiosoma, in the ♀ 33, 32, 31 and 38%.

Hypopus. A light russet yellow in colour. The lateral flanges of the propodosomal shield have a straight external edge, which is practically rectangular and is curved only at the apex. Length of idiosoma 272 to 308μ. Average length (of 10 individuals) was 290μ.

Habitat. It has only been found in Ostashkova in the Kalinin district.

7. Acotyledon alberti A.Z. (Fig. 354.)

This is very similar to the preceding species, from which it differs in some characteristics of the chaetotaxy, i.e. the setae of the idiosoma (especially the shorter ones) are thicker, straight, strong; their ends are visibly sharpened, not flattened; their lengths are almost the same as those of A. redikorzevi redikorzevi (perhaps a bit shorter), but d_3 are shorter (in the ♀ they equal d_2, in the ♂ they are 1.5 times longer). In the ♂ p_2 are on the same regular transverse line as p_3. Its size and other characters are the same as those of A. redikorzevi.

Hypopus. This is of the Cosmoglyphus type and similar to that of A. redikorzevi, it differs in being lighter in colour - a fairly light, yellowish brown, it is slightly transparent. The legs are pink or slightly wine-coloured. The lateral regions of the propodosomal shield are not so deeply excised. The peripheral setae of the idiosoma are like short spines. The anterior suckers of the sucking disc are considerably smaller than the central ones and slightly smaller than the posterior ones. The lateral suckers lie in the same transverse line as the middle pores of the central suckers. The outer ventral short spine of tibiae and genua I and II are visibly wider and shaped like a laurel leaf, according to Michael. Length 260μ, width 210μ.

Habitat. This has been found in England on decaying mushrooms, less abundantly on the stems of cabbages and other plants.

8. Acotyledon krameri Berl. (Figs. 234 to 238, 249, 250.)

Berlese, 1881, Atti R. Inst. Veneto. Sc., Lett. e Arti, ser V, Vol. VIII, 13; Kramer, 1899, 140 (Tyroglyphus); Oudemans, 1932, Entomol. Ber., VIII, 358, (Cosmoglyphus).

The idiosoma is narrow and elongated, 2.1 to 2.2 times longer than

its maximum width, becoming much narrower behind 1 p. Sc i is half the length of sc e; the distance between the setae sc i is less than 1.5 times greater than that between sc i and sc e; sc e is approximately 40% of the length of the idiosoma. The setae of the hysterosoma are of average length, thin, flexible and about the same length in the two sexes. Their lengths, expressed in percentages of the length of the idiosoma, are h e 25, h i 5, d_1 5, d_2 7, d_3 9 to 10, d_4 16, 1 a 6, 1 p 18, sa e 16, sa i about 30; d_2 is only slightly longer than d_1 and little less than d_3, 1 a is one-third the length of 1 p. The pseudostigmatic organ is thickly feathered, not thickened. The legs are long and slender. The ventral setae of the tarsus are fairly thin, not like short spines; the sensory club has a very feebly thickened end.

♂. Only the homeomorphic phase is known. P_1 are wider apart than p_3, the position of p_2 is not established. The distance between the posterior end of the anus and that of the body is almost twice the anal length. The distal part of the penis is straight. The legs are slightly longer than in the ♀; tarsus IV is fairly short and section ab is less than cd, but considerably longer than ef. Length 450μ.

♀. The postanal setae are inserted slightly behind the anal slit, this is very short and more posterior in position than usual, so that the distance between its anterior end and the genital slit is 8 times longer than the distance separating it from the posterior end of the body. The lengths of the legs I to IV are 40, 36, 34, 38 to 40% of the idiosoma. Tarsus IV is noticeably longer than the tibia and genu taken together. Length 630μ.

Hypopus. This is of the Cosmoglyphus type and very similar to that of A. redikorzevi, it differs from it in having the idiosoma more elongated; in cases where the lateral edges are completely flattened, its width is not more than four-fifths of its length. The edges of the hysterosoma are absolutely flat, distinct from the rounded portion. The rostrum is

wider, not drawn out into a small projection, triangular and shorter, it does not extend as far forward as a line drawn between the side flanges of the propodosomal shield; these side flanges are almost rectangular, rounded at their distal extremities and with straight external edges. The bifurcation of the sternum is more pronounced and it itself is longer. Correlated with the more elongated form of the body, the sternal and ventral shields are narrower. The distance between the posterior end of the sucking disc and the edge of the body is greater, and is equal in length to the sternal shield. The anterior peripheral suckers are considerably smaller than the central ones, and not much bigger than the posterior and lateral ones, the latter are slightly displaced forwards, and are anterior to a line drawn through the middle of the central suckers.

The legs are shorter; of leg I, part of the genu, tibia and tarsus protrude beyond the anterior edge of the excised propodosomal shield, whilst of leg II, only the distal third of the tibia and the tarsus extend beyond the edge of the lateral flanges. The sucking "hairs" of tarsi I and II are slightly wider; on tarsi III and IV, there are only 3 leaf-like widened setae, not counting the apical seta. Legs III and IV, particularly the femoral joints, are thinner. I have only seen one example of this species, whose length was 267μ and width 205μ. According to Berlese, the length is 300μ. A. krameri is allied to A. redikorzevi and A. alberti, from which it differs only in its more elongated idiosoma, by the ventral setae of the tarsus not being thickened short spines, and also in the position of the anal slit in the ♀.

Habitat. Certainly, it has only been found in Italy and the Ukraine, in State forests near Odessa it lives on decaying plants. The hypopi are carried by various small beetles, ants and ticks.

9. Acotyledon feytaudi Ouds.

Oudemans, 1928, Entomol. Ber. VII, 313 (Caloglyphus): 1932, ibid. VIII, 358 (Cosmoglyphus).

Only the hypopus has been described by Oudemans as follows: "in feytaudi the dorsal setae are at least 3 times longer and more flexible than in A. krameri, and the dorsal transverse row consists of 6 (not 4) setae (between the external and internal and anterior to the "fat" glands, there is an additional pair). The legs in feytaudi are shorter and thicker than in krameri; when the legs are extended in krameri, on looking from above, half of femur I can be seen; in the case of feytaudi, only the distal half of genu I. In krameri the line dividing the 4 coxae I and II from III and IV is slightly curved anteriorly; in feytaudi the curve is more pronounced. In krameri, the sucking plate is approximately quadrangular; in feytaudi it is almost hexagonal". If one takes into consideration the fact that Caloglyphus krameri Oudemans is not identical with Acotyledon krameri Berlese, but is very similar to (and possibly identical with) A. redikorzevi, it is then apparent that most of the characters of A. feytaudi are the same as those in which A. redikorzevi differs from the true A. krameri and the difference, therefore, between A. krameri and A. feytaudi, remains obscure. Such a difference is shown by the greater length of setae in A. feytaudi, which are the same size in A. krameri and A. redikorzevi.

Habitat. This was described from a specimen found in termites nests- Reticulitermes lucifugus Rossi - in Spain and Algiers.

10. Acotyledon batsylevi sp.n. (Figs. 223 to 226.)

Sc i are half the length of sc e; the distance between the 2 setae sc i is 1.5 times greater than that which separates each from sc e; sc e is 30 to 35% of the idiosoma in length. All the setae of the hysterosoma are fairly long, very thin, flexible and hair-like; their lengths, expressed as a percentage of the total length of the idiosoma, are - h e 25 to 30, h i and d_1 10 to 12, d_2 12.5 to 18, d_3 22.5 to 28, d_4 22.5 to 31, l a 16 to 18, l p 21 to 26, sa e 17 to 31, sa i 23 to 41. D_2 is thus considerably longer than d_1 and less than half the length of d_3. L p is

1.3 to 1.5 times longer than l a. The pseudostigmatic organ is flattened, broadly lanceolate, very strongly feathered at the edges, in addition there are 4 to 6 projections from its dorsal surface.

The legs are long and slender; on tarsi I and II, the middle and internal ventral setae are spines, similar to the ventral setae of tarsi III and IV. The olfactory club of tarsus I is very slightly club-shaped.

♂. The anterior setae of the postanal pair - p_1 - are slightly wider apart than p_3, p_2 are on the same level as p_3 and form a transverse row with them. The distance between the setae of the p_2 pair is 4 times less than that between the p_1 setae. The anal slit is separated from the posterior end of the body by a distance 1.5 times greater than its length. The tarsal suckers are more distal in position than in A. redikorzevi.

♂. Homeomorphic form. All the apical setae of tarsi I and II are simple, not widened at their ends.

♂. Heteromorphic form. The setae of the idiosoma are longer than in the homeomorphic form, as is usually the case. This is obvious in the following table, where the lengths of the setae - given as a percentage of that of the idiosoma - of the 2 forms are compared:-

	v i	sc e	sc i	h e	h i	d_1	d_2	d_3	d_4	l a l	p sa e	sa i
Homeomorphic	14.5	30	14.5	28	12	12	12.5	22.5	22.5	16	22	22.5	37
Heteromorphic	17	35	15	30	12.5	12	18	27	31	18	26	30.5	40

The legs are also longer and thinner than in the homeomorphic form - 47, 44, 34, 48% of the idiosoma - and the setae and spines on them are longer; the internal apical seta of tarsi I and II is distally enlarged into an oval transparent plate; the modified third pair of legs have only 1 spine on the ventral surface of a beak-like tarsus; the individual setae are flexible and unthickened. Length 437 to 550μ.

♀. Most of the setae of the idiosoma are the same length as those of the homeomorphic ♂; sa e (17% of the idiosoma) and sa i (23%) are noticeably shorter. The postanal setae are moved far back from the anal slit; the distance between the genital and anal slit is smaller than that between the posterior end of the anus and the posterior end of the body.

The average length of the legs is 36, 34, 35.5, 37% of the length of the idiosoma; tarsus IV is noticeably longer than the 2 preceding segments of the legs taken together, and is 6 times longer than its own diameter in the middle. Length 600μ, width 340μ.

Hypopus. This is similar to that of A. redikorzevi, but slightly larger in size and lighter in colour. Length 288 to 310μ.

Habitat. This has only been found in the suburbs of Voroshilovsk, N. Caucasus, where it lives in heaps of damp decomposing plants, in the residue and spillage from threshed wheat.

11. Acotyledon volgini sp.n. (Figs. 182 to 185.)

This is known only in the hypopial stage, which is characterised by its large size, considerably reduced propodosomal shield and by the chaetotaxy of its legs. It is dark brown in colour. The idiosoma is elongated, egg-shaped and almost truncate anteriorly, the ratio of length: breadth is 1.45:1. The dorsal surface is considerably and evenly arched and is smooth. The lateral edges of the hysterosoma are flat, but narrower than in specimens of A. krameri; the setae of its dorsal surface are short and straight. The propodosomal shield is plate-like and very short, the length of its visible part being one thirty-fifth of the length of the hysterosomal shield. The anterior edge of the propodosomal shield is feebly curved, with faintly marked lateral excisions and a slightly arched median part. The rostrum is the same shape as in A. redikorzevi and similarly bears at its end a pair of well-developed setae, but in this species they are displaced on to the ventral surface of the shield and are

completely concealed by its flattened anterior edge. The scapular setae are stout, sc e are straight and sharply bent at an angle, sc i are, as usual, arched and bent backwards. The gnathosoma is completely hidden by the overhanging edge of the propodosomal shield; it is large, twice as long as its greatest width at the middle, and narrows smoothly towards its anterior end; its apex is bifurcate over a distance equal to a quarter of its total length; the arists are long and almost straight.

Epimeres II extend to the end of the sternal shield, but they are not connected to the straight epimerites II by special sclerotised struts, as is the case in Forcellinia. The ventral shield is very large, considerably longer than the sternal. Coxal fields III and IV are open; epimeres IV are the same shape as those of A. redikorzevi, but with more widely separated ends. The ventral seam runs along the whole shield, as far as its posterior edge, the latter is the same shape as in A. redikorzevi and A. krameri. The distance between the posterior edge of the sucking disc and the posterior edge of the body is considerably shorter than the sternal shield. The distribution of the suckers and their relative sizes are the same as in A. krameri.

The legs are short and massive; the ends of the genu, the whole of the tibia and tarsus of leg I, and only the tarsus of leg II, protrude beyond the edge of the propodosomal shield. The ventral setae of leg I are lanceolate, flattened spines; the external ventro-lateral spines of genu I, tibiae I and II, are knife-shaped, roughly similar to those of A. redikorzevi. Tarsi I and II are considerably thickened in a dorso-ventral plane, their ventral setae arise from the outer rib of the tarsus, forming a sort of brush. The middle ventral seta is shaped like a strong spine; both laterals and 3 of the apical setae are considerably widened like leaves; their terminal lamellae have an elongated oval shape and a well-defined central vein. Legs III and IV are more massive than in A. redikorzevi; on tarsi III and IV, there are 4 considerably widened setae. Length of idiosoma 380μ, width 265μ.

Habitat. The type specimen was found in Bashkeria, A.S.S.R.

12. Acotyledon tshernyshevi sp.n. (Figs. 186, 251 to 253.)

Hypopus. This is of the Cosmoglyphus type. It is pale in colour, whitish and tinged with yellow. The idiosoma is widely egg-shaped, smooth, evenly and strongly arched; the setae which cover it are very short, straight and fine. The edges of the hysterosoma are not flattened and are continuous with its central region. The anterior edge of the propodosomal shield is truncate, with a slightly undulating edge; it does not form any rostrum; the length of its visible part, measured in the mid-line, is one-eighth that of the hysterosomal shield; v i are absent. The gnathosoma is 2.5 times longer than its width, with almost parallel edges, half of it projects beyond the propodosoma, its apex is slightly divided into 2, the arists converge freely and are slightly bent into arcs which are directed externally.

Epimeres II do not reach the posterior edge of the sternal shield, and they are not joined to epimerites II by a sclerotised strip, so that coxal fields II are open. Coxal fields II are almost closed and very widely separated. Epimeres IV are very strongly bent like arches. The longitudinal ventral seam is absent. The distance between the posterior end of the sucking disc and the posterior end of the body is less than the length of the sternal shield. The peripheral suckers are far removed from the ventral ones, the anterior ones are several times larger than the posterior and lateral, which are equal in size.

The legs are slender; tarsi I and II are cylindrical, not flattened. The ventral setae of trochanter I are very short; the ventro-lateral spines of genua and tibiae I and II are thin, almost straight and small in size. On tarsus I the middle ventral seta is spine-like. The preapical and apical setae, with the exception of the internal, are thin, straight, not widened distally; the internal, on the contrary, is widened and lanceolate; the sucking seta is thick, gradually widening towards a large, elongated "saucer"; on tarsus II, the internal apical seta is shaped like that on tarsus I, but the sucking seta is much smaller, and its terminal "saucer" is not separated from the stem. Tarsi III and IV have 5

spines broadened into a leaf shape. Length 245 to 285μ, width 200 to 240μ.

Habitat. It has only been found in the Ukraine, in the Odessa region, amongst dead wood and decaying vegetation. Possibly it is the same as A. eurynympha, of which only the hypopus and an insufficiently described nymph are known.

13. Acotyledon eurynympha Ouds.

Oudemans, 1912, Entomol. Ber. III, 189 (Tyroglyphus).

Hypopus. The name eurynympha is given because the deutonymph or hypopus is remarkably wide, almost circular; in other characters it resembles a typical Tyroglyphus. The legs bear big spines, much stouter than those of Hypopus spinitarsus Herm. The proterothorax (i.e. the propodosomal shield) is very short, produced forward as a triangle between legs I; 4 setae are present on the proterothorax and 10 pairs on the hysterothorax (= the hysterosomal shield); they are very short and thick. The macrosetae or "sleepharen" are missing, the lanceolate setae almost invisible; the claws are strong and hook-shaped ("boothakvormig"). It was found in decaying leaves in the Caucasus (Gaga) by Dr. Everts, who only found 1 specimen (according to Oudemans).

According to Vitzthum, this is the only one of the motile nymphs of the Tyroglyphidae which has setae on coxa I, whilst coxa III has only suckers. In all other species coxae I and III are armed in the same way; this last character should make the species easy to recognise. As there is no reference to it in the original description of Oudemans, one can only assume that Vitzthum had access to one of Oudemans' unpublished drawings.

9. Genus Caloglyphus Berlese.

Berlese, 1923, Redia, XV, 262 (Sbg.); Oudemans, 1932, Entomol. Ber., VIII, 357.

Type species: Caloglyphus berlesei Michael 1903.

Large, sometimes gigantic forms; ♀ 700 to 2,000μ, ♂ 500 to 1,100μ. The idiosoma has moderately protruding scapular regions; the lateral edges of the idiosoma between the scapular and l p setae are more or less concave, and more posteriorly, at the level of sa i, they converge smoothly; the posterior edge of the body is slightly concave, straight or even slightly convex. The external ventral and l of the apical setae of tarsi I and II are enlarged, arc-shaped and widened distally into a rounded or irregularly shaped transparent plate; the internal and median ventral setae of the same tarsi and the ventral setae of tarsi III and IV, sometimes only one, are modified into rather strong spines; the ventral setae of the tibia and genu are also more or less spine-like.

♂. Tarsal suckers are displaced to the extreme end of the tarsus.

♀. The anal slit is always far removed from the end of the body; there are 3 to 6 pairs of anal microsetae. Sexual dimorphism is usually pronounced. In the larval and nymphal stages, a series of setae - v e, sc i, h i, s h, d_1, d_2 and l a are considerably reduced. The strucutre of the hypopus is variable. To this genus belong, as well as 10 palearctic species, some tropical forms as well - C. weeversi Ouds. 1926, C. brasiliensis Ouds. 1924, Tyroglyphus unguiculatus Vitzthum 1924, T. spelaeus Berl. 1923, and also the N. American species - T. heteromorphus Felt. 1896, T. armipes Banks 1906, etc.

Caloglyphus Berl.

Males

1(6) Heteromorphic males.

2(3) Pseudostigmatic organs well-developed, setiform, equal in length to the diameter of tibia I; skin smooth; p_2 much longer than p_1, hair-like. Germany, U.S.S.R. (Moscow, Leningrad, Ivanovo, Jaroslavl,

Barnaul, N. Caucasus, Bachkeria).

1. C. rodionovi A.Z.

3(2) Pseudostigmatic organ shaped like a minute rod (5 to 8μ, only visible at high magnifications).

4(5) Cuticle of the hysterosoma distinctly rugose, pseudostigmatic organ visibly thicker towards its base, almost conical; p_2 much longer than p_1, hair-like; anal suckers of normal size. Mandzhuria (Kharbine).

3. C. mandzhur sp.n.

5(4) Cuticle absolutely smooth; pseudostigmatic organ cylindrical; p_2 very short, anal suckers very small. Germany, U.S.S.R. (Kiev).

4. C. spinitarsus Herm.

6(1) Homeomorphic males.

7(12) Anal suckers elliptical, strongly cuticularised, oblique; their posterior edges much more ventral in position than the end of the anal opening; the length of the latter is somewhat greater than that of the suckers; idiosomal setae strong, very stiff; small species, not more than 730μ long.

8(9) Tarsus IV bearing two strong curved setae; d_2 and d_3 approximately equal in length, appreciably shorter than 1 p and less than half the length of d_4. France, Holland, Germany, U.S.S.R. (near Moscow).

6. C. moniezi A.Z.

9(8) Tarsus IV with 1 curved seta; d_3 much longer than d_2 and 1 p.

10(11) All the tarsi bear strong curved setae; distal part of penis thin, straight; sc e, h e and 1 p not more than 40 to 50, sa e 15% of the length of the idiosoma. U.S.S.R., Trans Caucasus (Batum).

5. C. polyphyllae sp.n.

11(10) Tarsi III and IV devoid of strong curved setae; distal part of penis bent, forming an apparent obtuse angle with the stem when viewed ventrally; sc e, h e and l p 60 to 65%, sa e 25% of the length of the idiosoma. Italy.

7. C. berlesei Mich.

12(7) Anal suckers round or oval, their posterior edges placed well in front of the posterior end of the anal opening, the latter is 2 to 3 times longer than the suckers; idiosomal setae almost always thin and flexible. Variable in size (often very long, almost 110μ).

13(16) P_2 several times longer than p_1, setiform, extending well beyond the posterior edge of the idiosoma; idiosomal setae longer.

14(15) Cuticle of the hysterosoma finely rugose; pseudostigmatic organ in the shape of a very small rod (6 to 8μ) and conical; posterior edge of the propodosomal shield scalloped; the distance between the setae p_2 is half that which separates the p_1 setae; idiosomal setae longer. Mandzhuria (Kharbine).

3. C. mandzhur sp.n.

15(14) Cuticle absolutely smooth; pseudostigmatic organ well-developed, setiform, almost equal to the diameter of tarsus I; posterior edge of propodosomal shield not scalloped, straight or feebly convex; distance between the setae p_2 at least 2 to 2.3 times narrower than that between p_1; idiosomal setae shorter. Germany, U.S.S.R., (Moscow, Leningrad, Jaroslav, Barnaul, N. Caucasus, Bachkeria).

1. C. rodionovi A.Z.

16(13) P_2 equal in length to p_1, short; hysterosomal setae shorter.

17(18) Sensory club of tarsi I and II thin, cylindrical; idiosoma almost globular, 1.5 times longer than its maximum width; hypostome

with S-shaped lateral edges, which converge slightly anteriorly. U.S.S.R. (near Moscow).

8. C. sphaerogaster A.Z.

18(17) Sensory club of tarsi I and II stout, strongly expanded distally; idiosoma slender, almost twice as long as its maximum width, gnathosoma very narrow; hypostome strongly convering anteriorly, its lateral edges almost straight. France.

9. C. mycophagus Mégnin.

Females

1(2) Sensory club of tarsi I and II stout, strongly expanded distally; gnathosoma very narrow; hypostome with almost straight lateral edges which converge anteriorly. France.

9. C. mycophagus Mégnin.

2(1) Sensory club of tarsi I and II thin, cylindrical; proportions of gnathosoma normal; hypostome with strongly curved lateral edges, which converge anteriorly.

3(4) Lamellae of curved setae very wide. Pseudostigmatic organ absent.

5. C. polyphyllae sp.n.

4(3) Lamellae of curved setae narrower, lanceolate; pseudostigmatic organ present (often minute).

5(6) Pseudostigmatic organ well-developed, setiform, equal in length to the diameter of tarsus I; sa e very short, 8 to 9 times shorter than sa i; l p 2 to 3.5 times longer than l a; 5 pairs of anal microsetae, of which the 4 posterior are placed at approximately equal distances from each other, in a curved line on either side of the anal opening. Germany, U.S.S.R. (Moscow, Leningrad, Jaroslavl, Barnaul, N. Caucasus, Bachkeria).

1. C. rodionovi A.Z.

6(5) Pseudostigmatic organ very small (4 to 8μ), shaped like a rod (only visible at high magnifications); 3 to 6 pairs of anal microsetae arranged differently.

7(8) Only 3 pairs of anal microsetae; lamellae of curved setae of tarsi very narrow. Germany, U.S.S.R. (Kiev).

4. C. spinitarsus Herm.

8(7) 4 to 5 pairs of anal microsetae; lamellae of curved setae wider.

9(10) Legs very slender; d_3, d_4 and l p equal to 16 to 21% of the total length of the idiosoma; 4 pairs of anal microsetae, of which 2 are placed near the anterior end of the anal opening, 1 midway along it and 1 pair half-way between the median pair and the posterior end of the anus; genital palps, atrium and edge of anal opening rust-coloured. U.S.S.R. (near Moscow).

8. C. sphaerogaster A.Z.

10(9) Legs strong, d_3, d_4 and l p not more than 8 to 11% of the length of the idiosoma; 6 pairs of anal microsetae, of which 2 pairs are placed at the side of the anterior end of the anal opening, 1 at the middle and 3 others are clustered near its posterior end; genital palp, atrium and edge of anal opening not pigmented. Mandzhuria (Kharbine).

3. C. mandzhur sp.n.

Hypopi.

1(2) Coxal suckers replaced by setae; apical joints of gnathosoma wide apart, long (equal in length to the basal joint, which is square), subdivided into 2 joints; coxal fields III and IV separated by a wide longitudinal space. France.

9. C. mycophagus Mégnin.

2(1) Coxal suckers normal in structure; distal joints of gnathosoma nearer together, short (always much shorter than the basal joint), not subdivided, or else indistinctly so; coxal fields III and IV separated by a narrow longitudinal space.

3(4) Legs I and II very short and thick, conical, almost completely hidden beneath the propodosomal shield which is shaped like a crescent, its semicircular edge barely conceals all but the distal ends of tarsi I and the leaf-like setae of tarsi II; v i are placed on the ventral surface of the propodosomal shield at a fairly great distance from its anterior edge. A large species (400 to 420μ) found on Osmoderma eremita Scop. Germany, U.S.S.R. (Kiev).

4. C. spinitarsus Herm.

4(3) At least 3 joints of legs I and II extend beyond the edge of the propodosomal shield; legs slender; propodosomal shield more or less triangular, with a marked rostrum bearing the v i setae on its apex.

5(12) Gnathosoma completely hidden beneath the rostrum of the propodosomal shield, only the distal part of the arists project beyond it.

6(7) Propodosomal shield slightly shorter than half the hysterosoma; gnathosoma ovoid: its forked ends short, not separated from the basal joint; internal ventral seta of tibiae much larger than the external; epimeres II converging at a right angle; sternal shield outlined posteriorly by an arched line. Small species (200 to 235μ) whitish, often found in large numbers beneath the elytron of Geotropes stercorosus Först. U.S.S.R., France, Germany.

10. G. geotruporum sp.n.

7(6) Propodosomal shield not more than a quarter the length of the hysterosomal; divisions of the gnathosomal fork longer, clearly

separated from the basal part; internal ventral spine of tibiae II shorter than the external; epimeres IV uniting at an acute angle; sternal shield limited posteriorly by a trapezoid-shape line. Species larger.

8(9) Propodosomal shield equal to one-sixth of the hysterosomal; legs I and II short, very strong, only the genua, tibiae and tarsi extending beyond the anterior edge of the idiosomal shield; the tarsi very short, much shorter than the genu plus tibia taken together and only 1.2 to twice as long as their basal diameter; external ventral spines of tibiae I and II the same length as the tarsi; antero-lateral edges of propodosomal shield regularly, though feebly, convex over their entire length. Rostrum barely visible. Length 350 to 390μ. On Polyphylla fullo L. U.S.S.R. Transcaucasus (Batum).

5. C. polyphyllae sp.n.

9(8) Propodosomal shield 4.5 to 5 times shorter than the hysterosomal; legs I and II thinner; tarsi equal in length or greater than the genu and tibiae taken together and 3 to 4 times longer than their basal diameter; anterior edges of the propodosomal shield distinctly curved on either side of the well-defined rostrum.

10(11) Only half the genu, the tibia and the tarsus of leg II extend beyond the edges of the propodosoma; internal ventral spines of tibiae I and II much thinner than the external; lateral edges of the gnathosoma straight and parallel; rostrum less well-defined; the length of the ventral shield is not greater than its maximum width; the length of the sucking disc is only 3 times less than the maximum width of the body. Length 225 to 390μ. Frequently found beneath the elytra of cockchafers (Melolontha). France, Holland, Germany, U.S.S.R. (around Moscow).

6. C. moniezi A.Z.

11(10) The distal half of the femur, the genu and tibia and tarsus of leg II extend beyond the edges of the propodosoma; internal ventral spines of tibiae I and II almost as large as the external; lateral edges of the gnathosoma convex; rostrum very prominent; the length of the ventral shield is considerably greater than its maximum width; the sucking disc is 4 times wider than the body. Length 400 to 440μ. Transporting host unknown. Mandzhuria (Kharbine).

3. C. mandzhur sp.n.

12(5) All, or the distal half of, the fork of the gnathosoma extends beyond the apex of the rostrum.

13(14) The distal fork of the gnathosoma is not separate from the basal joint; gnathosoma pear-shaped, elongated, with all the distal half extending beyond the anterior edge of the propodosoma; lateral edge of the sternum strongly S-shaped; posterior suckers of the sucking disc slightly smaller than the anterior; ventral setae of tibiae I and II thin, not spine-like. Beneath the elytra of Oryctes nasicornis L. and Polyphylla fullo L. Italy.

7. C. berlesei Mich.

14(13) Distal forks of the gnathosoma form independent joints; basal joint with parallel edges; lateral edges of sternal shield almost straight; posterior suckers of sucking disc much smaller than the anterior; ventral setae of tibiae I and II are spines.

15(16) One-quarter to one-third of the basal joint of the gnathosoma and all of its forked region extend beyond the apex of the rostrum; its basal joint is 3 to 3.5 times longer than wide; propodosomal shield is 6 to 8 times shorter than the hysterosomal; internal ventral setae of tibiae I and II are slightly shorter than the external; external ventral seta of genua II is a spine; postanal setae are shorter than tibiae II. Germany, U.S.S.R. (Moscow,

Leningrad, Jaroslavl, Barnaoul, N. Caucasus, Bachkeria).

1. C. rodionovi A.Z.

16(15) Only the end of the distal joint of the gnathosoma extends beyond the rostrum, basal joint twice as long as wide. Propodosomal shield 4 times shorter than the hysterosomal; internal ventral setae of tibiae I and II 2 to 3 times shorter than the external. External ventral seta of genua II hair-like, postanal setae long, twice as long as tibiae II. U.S.S.R. (Odessa region).

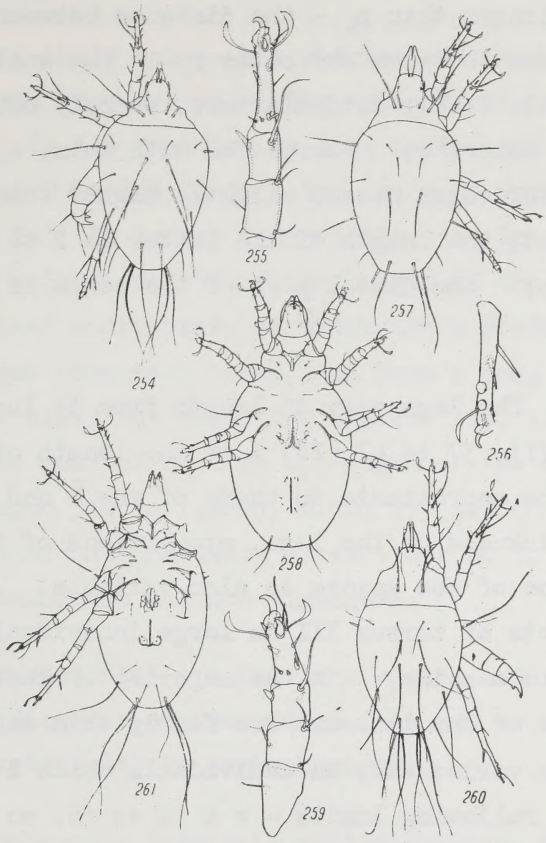
2. C. tshernyshevi sp.n.

1. Caloglyphus rodionovi A.Z. (Figs. 194, 195, 254 to 259, 262, 263, 268, 278, 288, 289, 295, 297, 298.)

Zachvatkin, 1935, 22, fig. 4, 22 to 24; 1937, 182, figs 1 to 13 and 25 to 30. Mycophagus Schulze, 1924, Ztschr. Morphol. u. Oekol. d. Tiere, II, 1 to 57, 17 figs. (Tyroglyphus) (non Mégnin, 1874).

Biology. Schulze, 1924, Ztschr. Morphol. u. Oekol. d. Tiere, II: 1 to 57; Shesterikova, 1932, Tr. N. and Inst. of Foodstuff industries I, Vol. 8; Zacher, 1927, Vorrats - Speicher u. Materialschädlinge. 269.

The pseudostigmatic organ is a well-defined bristle, 30 to 40μ in length; the dorsal setae of the hysterosoma are fairly long, not thickened; the posterior edge of the propodosomal shield is straight or slightly convex; anterior to the trochanter the lateral edges of the propodosoma are not sclerotised. There are no sclerotised sections around the sternum and no epimeres. The sickle-shaped setae of tarsi I and II terminate in a relatively narrow lancet-shaped plate, on tarsus III there is one seta of equal size, but the other is considerably narrower and longer; tarsus IV has one narrow sickle-shaped seta. The degree of sexual dimorphism is varied, but is well-developed, owing to the heteromorphism of the males. The cuticle is smooth.



Figs. 254 - 261

Fig.254- Caloglyphus rodionovi A.Z., heteromorphic ♂ , dorsal surface. Fig.255- C. rodionovi A.Z., leg I of the heteromorphic ♂ . Fig.256- C. rodionovi A.Z., tarsus IV of the heteromorphic ♂ . Fig.257- C. rodionovi A.Z., homeomorphic ♂ , dorsal surface. Fig.258- C. rodionovi, A.Z., ♀, dorsal surface. Fig.259- C. rodionovi A.Z., leg I, ♀. Fig. 260- C. mandzhur, sp.n., heteromorphic ♂ , dorsal surface. Fig.261- C. mandzhur, sp.n., homeomorphic ♂ , ventral view.

♂. Dimorphic, the heteromorphic phase being rarer than the homeomorphic. The cuticle is completely smooth and thin. P_2 are hair-like, long - 3 to 5 times longer than p_1 - the distance between them is 2 to 2.3 times less than that between the setae p_1. The anal copulatory suckers are egg-shaped, feebly cuticularised, sharply outlined posteriorly by a connecting sclerite; correlated with this, a line drawn through their posterior edges passes slightly higher than the posterior edges of the anal slit, the length of the latter is 2 to 2.5 times the length of the suckers; the distal part of the penis is straight and very thin.

Homeomorphic phase. The legs vary in length from 33 to 36 (I), 31 to 40 (II), 33 to 42 (III), 37 to 47 (IV) % of the length of the idiosoma, their relative lengths approximate to those of the ♀ and the heteromorphic phase; the thickness of the legs, proportions of the separate segments and the shape of the spines is also variable. The posterior (internal) ventral seta of tarsus III in large individuals (over 1,000μ) only is converted into a spine, in the majority of cases it is not modified. The setae of the idiosoma are fairly thin and flexible, their lengths are also very varied and, in individuals which I have measured, fluctuate within the following limits - v i 12 to 15, sc e 32 to 40, sc i 7 to 11, h e 25 to 43, h i 5 to 9, d_1 4 to 6, d_2 8 to 13, d_3 18 to 40, d_4 26 to 55, l a 7 to 11, l p 22 to 35, sa e 5 to 11, sa i 34 to 66% of the length of the idiosoma. Length 588 to 1,000μ.

Heteromorphic phase. Legs I, II and IV are long and slender, their lengths are 38 to 45 (I), 40 to 48 (II), 36 to 40 (III), 42 to 53% (IV) of the length of the idiosoma; the spines of the legs are long and knife-shaped. The setae of the idiosoma are, on an average, much thicker than in the homeomorphic individuals; they are stiffer and enlarged basally into a bulbous shape; their lengths, expressed as a percentage of the idiosoma, are v i 11 to 14, sc e 35 to 40, sc i 11, h e 31 to 35, h i 8 to 9, d_1 6 to 7, d_2 21 to 22, d_3 41 to 45, d_4 45 to

50, 1 a 11 to 12, 1 p 33 to 40, sa e 10 to 15, sa i 44 to 52. Length 705 to 950μ.

♀. The legs and their spines are shorter and more massive than in the ♂, the proportions very varied. The setae of the idiosoma are thin and flexible, d_2 is 1.5 to twice as long as d_1, and 2 to 3 times shorter than d_3; 1 p is 2 to 3.5 times 1 a; sa e is very short, 8 to 9 times shorter than sa i. In longer individuals, the length of d_3 and d_4 is 18 to 20, and 1 p is about 15% of the length of the idiosoma. There are 6 pairs of anal microsetae, of which the 4 posterior ones are placed at equal distances from each other, and form a long curved row on each side of the anal slit, the remaining 2 pairs lie, as usual, at its anterior end. The genital suckers and edges of the anal slit are non-pigmented. Length 510 to 1,240μ, width 255 to 860μ.

The eggs are of the following sizes: 110 x 80 to 210 x 125μ; the chorion is non-thickened and non-pigmented.

Larva. The "bruststiele" are fairly slender, moderately thickened distally, their diameter at its widest does not exceed 5μ, the apical dome of the "bruststiele" is semispherical.

Hypopus. Its colour is intensely yellowish-pink, its appendages darker, the idiosoma is 1.5 times its width, and elliptical; the integument is dense and moderately cuticularised. The propodosomal shield is one-sixth to one-eighth of the hysterosomal, approximately triangular; the rostrum is moderately extended and terminates in an obtuse angle with a rounded apex; the anterior lateral edges of the shield are slightly concave on either side of the rostrum; externally they are feebly convex. Sc form a feebly arched, anteriorly convex row; v i are placed on the apex of the rostrum. The hysterosomal shield has a very feebly arched, almost straight, anterior edge; the transverse striation at the anterior edge is very feebly marked; the remainder of the surface of the shield is very finely pitted, without any deep punctuations. The setae of the hysterosoma are very short;

sa i are placed considerably anterior to the postanals and noticeably internal to them; p a are considerably shorter than tibia II. The gnathosoma is narrow and long, protruding beyond the apex of the rostral protrusion, with the distal end of the basal segment and its forks visible from above; the basal segment has straight parallel edges and is 2 to 3.5 times its width, the distal segments are cylindrical and very close to each other. The sternal shield is well defined laterally by the S-shaped epimerites II, without a defined posterior edge; coxal fields II are closed, epimeres II converging at an acute angle; coxal fields III and IV are well-defined, separated along the mid-line by a narrow longitudinal space; epimeres III are arched; the genital shield is clearly-defined; the coxal and genital suckers, in addition to the posterior and external ones on the sucking disc, are fleshy and shaped like mushrooms; the genital suckers are placed further from the genital slit than from the external edges of the genital shield; the external and posterior peripheral suckers are half the size of the central ones; the anterior ones are almost the same size as the central ones; the width of the sucking disc is slightly more than one-third the width of the idiosoma; each of the genital suckers has a blunt rounded apex. The legs are long and slender, their average lengths expressed as percentages of the idiosoma are 40, 36, 32 and 32; that part of leg I distal to the middle of the femur protrudes beyond the edge of the propodosoma, on leg II that part distal to the genu; the tibia is noticeably longer than its diameter; the lengths of tarsi I and II are 5 to 7 times greater than their diameter at the middle and usually exceed the combined lengths of the tibiae and genua; the external setae of the genu resemble spines; the ventro-lateral setae of the tibia are in the form of moderately thick, slightly crooked spines, the internal ones slightly smaller than the external, the latter are 2 to 2.5 times shorter than the tarsi; on tarsi I and II are 5 leaf-shaped setae, of which 2 are much smaller than the remaining 3; their expanded ends are narrow, lance-shaped, slightly bent terminally and without a longitudinal vein; the sucking setae have a large, but narrow "saucer". The sensory rod is straight,

very thin, only slightly thickened distally; delta is placed considerably in front of gamma and is shaped like a very small, simple seta; eta is a strong, slightly bent seta placed well distal to the base of the sensory rod, but is more proximal in position than delta. On tarsi III there are 4, on tarsi IV 3 lance-shaped, short setae, the middle dorsal seta of tarsus IV is 1.5 times longer than the tarsus. Length 252 to 340μ, width 170 to 220μ.

Habitat. It has certainly only been recorded from Russia, (Moscow Leningrad, Jaroslavl, Barnaoul and certain places in the N. Caucasus and Bashkeria), and Germany.

Ecology. This is a synantropic species which lives on damp seed (mainly on spillings of grain in cellars), oil-containing seeds, oatmeal, flour sometimes on decaying onions and other root vegetables. Under field conditions it is usually found in decaying straw and other waste refuse in proximity to inhabited places, evidently only in more southern regions, it is a highly hygrophilic and thermophilic species which develops well on a substrate containing not less than 22 to 25% moisture, and not more than 80%. Its minimum temperature for development is 16.5°C., its optimum 29 to 30°C.; at the optimum temperature and humidity, its incubation period is $1\frac{1}{2}$ to 2 days; the post-embryonic development takes from 5 to 9 days. Owing to its great speed of development and high fertility (one ♀ can, under optimum conditions lay up to 621 eggs), its numbers increase very rapidly and it is usually found in enormous colonies. Hypopi are carried by the flour beetle - Tenebrio molitor and other granary insects. According to Schulze, this species often attacks live insects and their larvae and sometimes causes considerable damage to cultures of flour maggots. The food substrate is only damaged when the humidity is high.

2. Caloglyphus tshernyshevi sp.n. (Figs. 264, 299, 300.)

This is only known as the hypopus which closely resembles that of C. rodionovi and differs only in the following characters: the propodo-

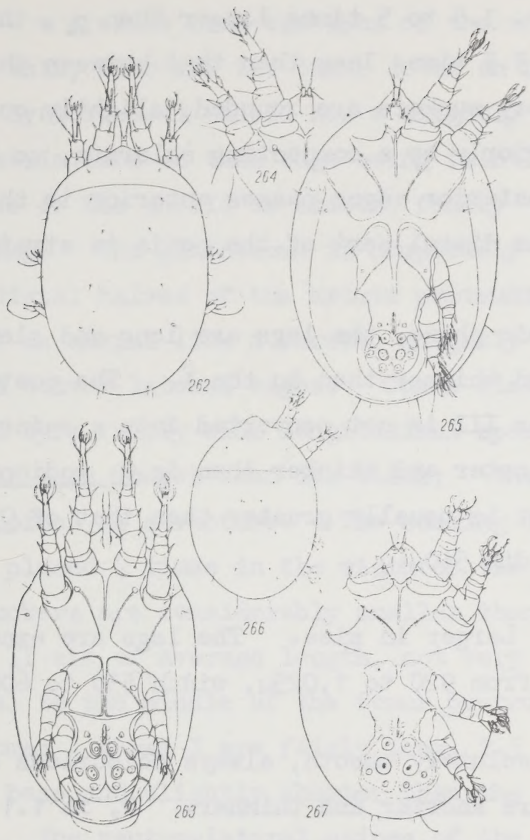
somal shield is noticeably longer, slightly less than a quarter of the length of the hysterosomal; the postanal setae are considerably longer, twice as long as tibiae II, flexible and hair-like; the gnathosoma is considerably shorter, with the end of its forked distal segment protruding beyond the apex of the rostrum, only the basal segment is twice as long as its width; coxal fields II are open; the coxal, genital, posterior and lateral suckers are less fleshy than in C. rodionovi. The legs are of the same proportions as those of C. rodionovi; the external seta of genu I is thin and hair-like, the internal ventral setae of tibiae I and II are very small, 2 to 3 times shorter than the external; the sensory rod of tarsi I and II is slightly shorter and more sharply distended towards its end; delta is the same length as gamma; 4 leaf-like setae are present on tarsus I, 3 large and 1 shorter; the middle dorsal seta of tarsus IV is considerably shorter. Length 225 to 350μ, width 175 to 240μ.

Habitat. It is found in forest litter and under the bark of tree stumps in the deciduous forests of the Odessa region (Nerubaefskii forestry commission).

3. Caloglyphus mandzhur sp.n. (Figs. 40, 260, 261, 265, 280, 287, 301, 302.)

The pseudostigmatic organ is very small (6 to 8μ), shaped like a straight rod which widens towards its base. The propodosomal shield has a more or less deeply indented posterior edge; the lateral surface of the propodosoma anterior to trochanter I and the irregular surfaces around the sternum and epimeres are densely cuticularised, but only slightly coloured. The sickle-shaped setae of tarsi I to III resemble those of C. rodionovi, but are slightly more pointed; on tarsus IV there is one sickle-shaped seta, similar to those found on the anterior legs.

♂. Dimorphic, the heteromorphic form being more numerous than the homeo-



Figs. 262 - 267

Fig.262 - Caloglyphus rodionovi, A.Z., hypopus, dorsal surface. Fig.263 - Ditto, ventral surface. Fig.264 - C. tshernyshevi, hypopus, anterior part of body with legs I and II, ventral surface. Fig.265 - C. mandzhur sp.n., hypopus, ventral surface. Fig.266 - C. geotruporum, sp.n., hypopus, dorsal surface. Fig.267 - Ditto, ventral surface.

morphic. The cuticle is more dense than in other species, finely and thickly striated longitudinally, especially on the hysterosoma (it needs a high magnification to see this) and often dirty brown in colour. P_2 are long and hair-like, 3.5 to 5 times longer than p_1, the distance between the p_2 setae is 3.5 times less than that between the p_1 setae.

The anal copulatory suckers are rounded, slightly cuticularised, sharply defined posteriorly by a connecting sclerite, so that a line drawn through their posterior edges passes anterior to the posterior end of the anal slit. The distal part of the penis is straight and very thin.

In the homeomorphic phase, the legs are long and slender, always considerably longer and thinner than in the ♀. The posterior (internal ventral) seta of tarsus III is not converted into a spine. The setae of the idiosoma are shorter and thicker than in C. rodionovi. The length is variable, but is usually greater than that of C. rodionovi. Length 690 to 965μ, width 510μ.

Heteromorphic phase. Larger in size. The legs are exceptionally long and slender. Length from 920 to 1,025μ, width 530 to 600μ.

♀. The cuticle is absolutely smooth, always colourless and thinner than in the ♂. The legs are shorter and thinner. D_2 is 1.1 to 1.7 times longer than d_1 and not more than 1.7 times shorter than d_3; 1 p is 2 to 3.5 times 1 a; sa e is relatively long, only 2 to 2.6 times shorter than sa i; there are 6 pairs of anal microsetae, of which 2 are placed near the anterior end of the anal opening, 1 at its middle and 3 close together at its posterior end. The genital suckers and edge of the anal slit are non-pigmented. Length 860 to 1,400μ, width up to 860μ. The eggs are from 175 x 113μ to 220 x 140μ. The larva is characterised by its long (23 to 24μ), strongly distended and thickened "bruststiele", their inflated distal part reminding one of an acorn in its cup.

Hypopus. A light dirty brown in colour. The idiosoma is elliptical, 1.6 times its width in length, its cuticle dense and strongly cuticular-

ised; the propodosomal shield is a quarter the length of the hysterosomal, with a narrow, triangular, anteriorly projecting rostrum, this is clearly separated from the anterior lateral edges of the shield which are arc-shaped; v i arise from the apex of the rostrum. Sc are relatively long and thin, like all the other setae on the dorsal surface of the body. The hysterosomal shield has a slightly convex anterior edge, the transverse striations on this edge being faintly indicated, the remaining surface of the shield is smooth, finely punctuate and without any coarse pitting. The gnathosoma is completely concealed by the rostrum, only the distal halves of the arists protruding beyond its apex. The main segment is shaped like a barrel, slightly longer than wide and with well-marked convex lateral edges. Coxal fields III are well-defined, divided by a fairly wide longitudinal space, on the whole the ventral shield is much longer than its width; the coxal suckers are very small and normal in structure. The sucking disc is not large (its diameter can be placed 4 times in the width of the body); the external and posterior suckers are considerably smaller than the anterior ones.

Legs I and II are of average length, not very thick, with that part of the leg distal to the middle of the femur protruding beyond the edge of the propodosoma; tarsi I are fairly long, 2.5 times longer than their diameter at the base, and slightly shorter than the combined length of the tibia and genu; the ventro-lateral spines of the tibia and genu are fairly long, straight, cylindrical, not flattened, the internal ones are only slightly shorter than the external; the leaf-like setae of the tarsi are thick, their lance-shaped ends terminating in a thin, sharp point; only one of them is noticeably smaller than the rest. The sensory rod is straight, fairly massive, feebly expanded distally. The ventral setae of tibiae III and IV are shaped like spines, on tarsi III both of the basal ventral ones being slightly widened distally; the middle dorsal seta of tarsus IV is almost twice as long as the tarsus. Length 339 to 400μ, width 260 to 275μ.

Habitat. Harbin, in Manchuria.

Ecology. It was found in large numbers on the decaying heads of garlic. Many of the females contained as many as 45 eggs each, in others one could see fully developed larvae and their empty egg shells; like C. moniezi, it is therefore facultatively viviparous.

4. Caloglyphus spinitarsus Herm. (Figs. 281, 282, 306.)

Hermann, 1804, Mém. Aptérol. 85, t. VI, fig. 5 (Acarus); Oudemans, 1924, Entomol. Ber., VI, 323, fig. (Hypopus); 1932 ibid., VIII, 358, fig. Caloglyphus).

♂. Heteromorphic form. Length 715μ, width at the shoulders 370μ. The lateral edges of the body as far as l p are almost parallel, the posterior edge rounded. All the setae are longer than in the ♀. I did not notice any longitudinal grooves on the dorsal surface, possibly on account of the swelling caused by the lactic acid or chloral hydrate. The genital opening is 85μ long, similar to that of the tritonymph, its distance from the anus is 18μ; the anus is 100μ long and 200μ from the posterior edge of the body; each anal fold bears one seta; the anal suckers are extremely small. Posterior to the anus are 3 pairs of short setae and one pair of long.

The legs are long, leg III being thickened. Tarsus IV has 2 suckers placed distally - a character not observed in any other species. If the field of focus is lowered when the genital opening is being examined, it is possible to see that the penis is very small, it is narrow anteriorly, in the middle it suddenly broadens and becomes still wider posteriorly. The lance-shaped setae of tarsi I and II are wider than those of the ♀, which are very narrow. The maxillary coxa is considerably narrower than in the ♀. The homeomorphic phase is unknown.

♀. Length (without gnathosoma) 711μ, width at the shoulder 311μ; "fatty" glands 370μ long. The edge of the body between the shoulder and "fatty" gland is slightly concave; the posterior edge is obtuse, even slightly concave (this is typical of the genus Caloglyphus). The humeral setae

are more ventral in position than dorsal, the lateral and 4 sacral setae are long; sa e are submarginal, longer than the others and equal in length to legs I; sc i, h and d are slightly longer than the width of the tarsus. The dorsal surface has the same thin lines as the tritonymph. The genital opening is small (100μ), the distance between it and the anus being 95μ; the anus is 122μ long and the distance between it and the posterior edge of the body is 155μ. The genital folds each have 2 setae, the anal 3 very small setae. As in the tritonymph, two pairs of setae arise submarginally. The copulatory opening is ventral. The shortness of the legs is characteristic (Oudemans, 1932).

In addition to the description, a note appears in a paper by Oudemans (Acarol. Aanteek., CXII) entitled "Tracheae in Acaridae" in which the pseudostigmatic organ is illustrated and called the supracoxal hair; it has the appearance of a short straight rod rounded at the end. These characters lead one to think that C. spinitarsus is closely related to C. sphaerogaster and particularly to C. mandzhur. From the first species it is distinguished by the slender build of the body, by the pronounced sexual dimorphism (shown by the setal length, length of legs and proportions of the gnathosoma) and heteromorphism of the ♂; it differs from C. mandzhur by having very small anal copulatory suckers and short postanal setae - p_1 and p_2, and by having only 3 pairs of anal microsetae in the ♀.

Hypopus. This differs markedly from all other species in its large size, very short fat legs and abnormal shape of the hysterosomal and propodosomal shields. Its colour is yellow brown. The idiosoma is 1.35 times longer than its width; the hysterosoma has a very regular elliptical form and is 13 times longer than the narrow plate-like propodosomal shield, this protrudes anteriorly in a crescent shape. The cuticle is very dense and well-cuticularised; the dorsal surface is not pitted and all the setae arising from it are very short. Sc are placed in an arc-shaped row parallel to the anterior edge of the hysterosoma; v i

are displaced on the ventral surface of the propodosomal shield and are inserted considerably away from its anterior edge. The anterior edge of the hysterosomal shield is arched, convex and regular in shape, with an indefinite transverse striation; d_1 and h i are displaced to its lateral edges and h e on to the ventral surface; sa i are somewhat internal to p a, the latter being relatively long. The gnathosoma is more posterior than usual and is completely hidden beneath the overhanging propodosomal shield (including the arists), its basal segment is slightly longer than its width, with parallel lateral edges; the distal segments are well-defined and 1.5 times shorter than the basal. The sternal shield is only feebly marked posteriorly, but its lateral edges are more clearly defined by the straight epimeres II, whose ends are slightly bent externally; coxal fields III are widened slightly and feebly outlined; coxal fields IV are not separated by the middle line of the body and are barely separated from the genital shield; the coxal suckers are normal. The sucking disc is very large, with widely separated suckers, whose sizes have the same relationship as those of C. polyphyllae, but the auxiliary suckers are much bigger.

Legs I and II are short and thick (about 20% of the length of the idiosoma), conical and almost completely hidden beneath the body; beyond the anterior edge of the propodosomal shield project only the end of tarsus I, the claw and the leaf-shaped sucking "hair" of tarsus II; the tarsi are short, twice as long as their diameter at the base; the tibia, genu and femur are narrow and annular; the ventral setae of the tibia and the external setae of the genu are short, but thick; the leaf-shaped setae of the tarsi have a very broad strongly twisted plate with a well-defined middle vein, they are all large; the sucking setae are longer than the tarsi and have a narrow "saucer"; the sensory rod is long, slightly bent and expanded distally; gamma arises slightly anterior to the base of the sensory rod; eta is a thick, stout seta in the middle of the tarsus. Legs III and IV are of approximately the same length as the anterior ones; the ventral setae of the tibia are slightly thickened; there are 5 leaf-like setae on each tarsus,

the dorsal setae of tarsus IV are shorter than the tarsus itself. Length 400 to 420μ, width 200 to 310μ.

Habitat. France, Germany, U.S.S.R. (near Kiev), its presence in England has not been confirmed.

Ecology. The hypopus is usually found on Osmoderma eremita Scop., it has also been recorded from Carabus nemoralis O.F.M. (Vitz. 1931).

5. Caloglyphus polyphyllae sp.n. (Figs. 269 to 273, 283, 284, 294, 304, 305.)

The pseudostigmatic organ is absent; the dorsal setae of the hysterosoma are short, thick, widening like cones towards the base. The outline of the propodosomal shield is not clear; the cuticularised parts anterior to trochanters I and around the epimeres are absent. The sickle-shaped setae of all the tarsi have a very broad oval plate. The cuticle in both sexes is smooth, and normal sexual dimorphism is very clearly shown.

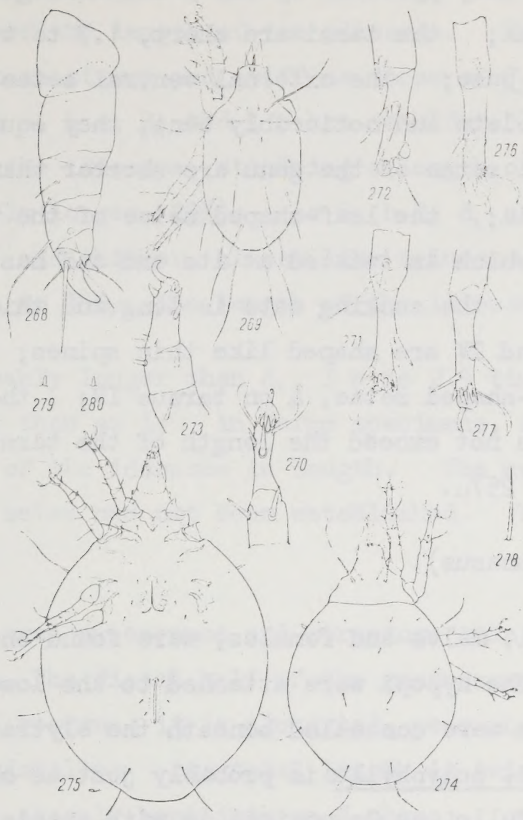
♂. This is only known in the homeomorphic form. P_2 are short, approximately equal to p_1, the distance between the 2 setae p_2 is half that between p_1 setae; the anal copulatory suckers are large, oblique, elliptical and very strongly cuticularised and raised, their lateral edges extend considerably further back than the anal slit; the distal part of the penis is straight and very narrow.

The legs are very long and fairly wide, legs I being considerably shorter than the others. All the setae of the genu and tibia, as well as the ventral setae of all the tarsi (including both setae of tarsus III) are represented by long, knife-shaped setae; the ventral apical setae of the tarsi are very long and slender (particularly the central ones); the tarsi widen strongly like cones towards the base, becoming sharply narrowed before the middle and then widening. The long setae of the idiosoma are thick and very hard, strongly thickened basally and similar

in structure to those of the heteromorphic forms of C. rodionovi; the shorter setae (sc i, h i, d_1 and l a) are also fairly strong. Length 560 to 640μ.

♀. The legs are short and thick; the setae of the genu, tibia and tarsi are thick and straight. The setae of the idiosoma are straight and short, it is not possible to give their lengths, or the number and distribution of the anal microsetae owing to bad condition of the females. Length 700 to 1,000μ.

Hypopus. Brownish-yellow in colour. The idiosoma is 1.5 times longer than its width and elliptical, the cuticle covering it being dense and well-cuticularised. The propodosomal shield is one-sixth the length of the hysterosomal, its anterior edges are rectangular with rounded apex and sides which are slightly convex over their entire length. Sc are arranged to form a trapezoid; v i are displaced on to the ventral surface of the shield, and are inserted slightly away from the anterior edge on the apex of an elongated protrusion. The hysterosomal shield has an arch-shaped convex anterior edge which is clearly separated posteriorly; the anterior portion of its surface is covered with very sharp transverse striations (composed of thin ridges); the whole of the remaining surface of the shield is covered with scattered pits; the setae of the hysterosoma are fairly thin. The gnathosoma, except for the distal half of the arists, is completely hidden beneath the overhanging edge of the propodosomal shield; its basal segment has parallel sides and is 1.5 times longer than its width. The sternal shield is well-defined, with slightly concave lateral and posterior edges, coxal fields II thereby remaining open; coxal fields III are well defined and slightly spread out; coxal fields IV are very faintly outlined and not separated from the genital shield. The coxal suckers resemble medium-sized buttons. The sucking disc is not large (its width is less than a third of that of the idiosoma); the peripheral suckers are 1.5 times less than the central ones, the external are slightly displaced posteriorly and the genital ones have a conical pointed apex.



Figs. 268 - 280

Fig. 268 - Caloglyphus rodionovi A.Z., leg III, heteromorphic ♂. Fig. 269 - C. polyphyllae, sp.n., ♂, dorsal surface. Fig. 270 - C. polyphyllae, sp.n., tibia and tarsus II, ♂, ventral view. Fig. 271 - C. polyphyllae, sp.n., tibia and tarsus III, ♂, ventral surface. Fig. 272 - C. polyphyllae, sp.n., tibia and tarsus IV, ventral view ♂. Fig. 273 - C. polyphyllae, sp.n., genu, tibia and tarsus I, ♀. Fig. 274 - C. sphaerogaster A.Z., ♂, dorsal surface. Fig. 275 - C. sphaerogaster A.Z. ♀, ventral surface. Fig. 276 - C. sphaerogaster A.Z., tibia and tarsus IV of ♂. Fig. 277 - C. sphaerogaster A.Z., tibia and tarsus III of ♂. Fig. 278 - C. rodionovi A.Z., pseudostigmatic organ. Fig. 279 - C. sphaerogaster A.Z., pseudostigmatic organ. Fig. 280 - C. mandzhur sp.n., pseudostigmatic organ.

Legs I and II are very massive and short - 25 to 28% the length of the idiosoma - and they protrude by the 3 distal segments beyond the edge of the propodosoma; the tarsi are short, 1.7 to twice as long as their diameter at the base; the external ventral setae of the tibia are very large, lanceolate and noticeably bent, they equal the tarsi in length; the external setae of the genu are shorter than the corresponding setae of the tibia; the leaf-shaped setae of the tarsi have a very wide oval plate which is twisted at its end and has a clearly defined central "vein"; the sucking seta is long and thick; the ventral setae of tibiae III and IV are shaped like thin spines; on tarsus III, there are 6 wide leaf-shaped setae, 4 on tarsus IV; the middle dorsal seta of tarsus IV does not exceed the length of the tarsus. Length 350 to 386μ, width 235 to 257μ.

Habitat. Batumi (Caucasus).

Ecology. Many hypopi, males and females, were found on Polyphylla fullo L. - a cockchafer. The hypopi were attached to the lower sides of the abdomen and the adults were concealed beneath the elytra of a related species of chafer. C. polyphyllae is probably just as closely associated biologically with P. fullo, as C. moniezi is with species of Melolantha.

6. Caloglyphus berlesei Michael. (Figs. 293, 312 to 315, 355.)

Michael, 1903, 116 (Tyroglyphus); - mycophagus Berlese, 1891 (non Mégnin, 1874), LVIII, No. 1; Kramer, 1899, 139, fig. 30 (Tyroglyphus).

This is closely allied to the preceding species, but differs in having sickle-shaped setae only present on tarsi I and II.

♂. Only the homeomorphic form has been found. The distribution and relative lengths of the setae of the postanal complex, the structure of the anal suckers and slit are similar to those of C. polyphyllae; the distal part of the penis is bent at an angle to the base, so that the penis from the ventral aspect appears blunt. The legs are very slender

and even longer than those of C. polyphyllae; their lengths are (all measurements are taken from Berlese's drawing) - 50 (I), 52 (II), 55 (III), 57 (IV) % of the length of the idiosoma. The long setae of the idiosoma are just as strong and stiff as those of C. polyphyllae and even longer; sc e, h e, d_3 and l p are considerably longer than the maximum width of the idiosoma, attaining a length of 60 to 65%: sa e are also noticeably longer (25%); sc i, h i, d_1 are, on the contrary, shorter (5 to 6%) and thicker, almost like spines. The total length of the body is up to 750μ, the length of the idiosoma 670 to 690μ.

♀. D_3 is noticeably longer than d_1, l p is 2.5 times l a; sa e is 2.5 times shorter than sa i; in large specimens, d_3, d_4 and l p do not exceed 10 to 11% of the idiosoma in length. The number and distribution of the anal setae nas not been established. Total length of the body is 1,300μ.

Hypopus. In general appearance and structure this is similar to that of C. rodionovi. The distal half of the gnathosoma protrudes beyond the obtuse-angled rostrum, it is elongated, pear-shaped and unsegmented, only bifurcated distally; its total length is twice its maximum width. Epimerites II are sharply bent into an S-shape; coxal fields III are very clearly outlined, with long, oblique antero-lateral edges, which clearly form an obtuse angle with their straight anterior edge. The posterior and lateral suckers of the sucking disc are almost the same size as the central ones, circular and regular.

Legs I and II are relatively long and slender, more slender and slightly shorter than those of C. rodionovi (30 to 33% of the length of the idiosoma); the chaetotaxy is not so well-developed as in other species; the ventro-lateral setae of the tibia and genu do not resemble spines; all the setae of tarsus IV are shorter than the tarsus.

Habitat. It has only been recorded from Italy.

Ecology. It was found on mushrooms and rotting potato tubers. The

hypopi were found on the dorsal surface of the abdomen and under the wings of the beetles Oryctes nasicornis and Polyphylla fullo L.

7. Caloglyphus moniezi A.Z. (Figs. 285, 303.)

Zachvatkin, 1937, 185, fig. 31. - mycophagus Moniez 1892 (non Mégnin, 1874), Mem. Soc. Zool. France, V, 584; 8 figs.; Oudemans, 1907, Entomol. Ber., 1, 223; Vitzthum, 1924, Arch. Naturg., XC, 10: 60, fig. 42 (Tyroglyphus).

This species, insufficiently described, is undoubtedly related to C. polyphyllae and C. berlesei; the main differences are in the structure of the hypopus. The adult differs from that of polyphyllae in having 2 sickle-shaped setae on tarsus IV and in the long setae of the idiosoma having finely serrated ends; from C. berlesei it differs in having large, sickle-shaped setae on tarsi III and IV. The pseudostigmatic organ, dorsal setae of the hypostome, distribution and size of the postanal setae of the ♂, and the number of anal microsetae in the ♀, all remain unknown, as Moniez did not describe or figure them. Sexual dimorphism is apparent, the ♂ being much smaller than the ♀.

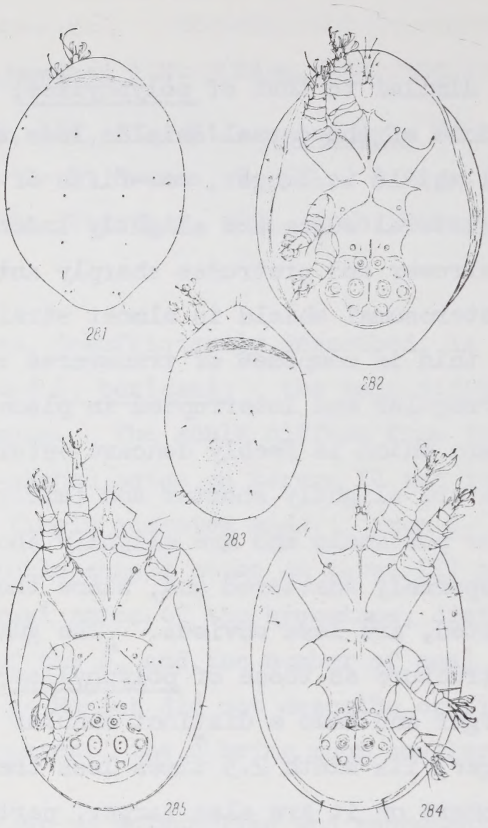
♂. This is similar to polyphyllae and represented only by the homeomorphic phase; the structure of the copulatory apparatus is the same as that of polyphyllae. The setae of the idiosoma are rigid and do not vary in length, as far as one can judge; d_2 are almost equal to d_3, shorter than 1 p and less than half as long as d_4. The total length of the body is up to 810μ, the idiosoma does not exceed 720 to 730μ.

♀. This is characterised by having 2 forms of ♀, one normal in size with a total length of 1,050 to 1,250μ, which lays a large number (about 35) of whitish eggs; the other is a gigantic viviparous type - 2,000 to 2,262μ, dull grey or brick red in colour and almost incapable of independent movement owing to the excessively distended hysterosoma. Besides eggs in different stages of development, these females also contain larvae

and protonymphs and even completely developed hypopi. The eggs are 153 to 180μ long and 99 to 117μ in diameter; the larvae have not been accurately described.

Hypopus. This is very similar to that of polyphyllae, but paler in colour and with the cuticle of the dorsal shields less well cuticularised. The propodosomal shield is longer, one-fifth of the hysterosomal in length; its antero-lateral edges are slightly indented in front, the rostrum is rather narrower and protrudes sharply anteriorly; the anterior edge of the hysterosomal shield is almost straight, its sculpturing more delicate; this is composed of transverse rows of minute protrusions which are irregular and interrupted in places. The sc setae are placed in an arc which is feebly concave anteriorly. The setae of the hysterosoma are slightly shorter and fairly coarse; sa i arise more closely to the postanals and are slightly shorter; the pits on the shield are more sparsely scattered and, since they are less dense and only slightly pigmented, are less obvious. The gnathosoma and coxal shields have the same structure as those of polyphyllae; the sternal suckers are slightly larger and have a distinct annular thickened edge. The sucking disc is larger, its width 2.5 times less the maximum width of the idiosoma, the suckers on it are also larger, particularly the peripheral and supplementary ones; the genital suckers have a widely rounded, dome-shaped apex.

Legs I and II are slightly longer (28 to 30% of the idiosoma) and considerably more slender; the length of their tarsi is 3 times their diameter at the base and almost 4 times their diameter in the middle; tibia I is noticeably longer than its diameter; the external ventral seta of tibia I and II is considerably shorter and thinner than in C. polyphyllae (they do not usually exceed half the length of the tarsi); the leaf-shaped setae of tarsi I and II are narrower, lanceolate, widening more gradually towards the middle and less sharply twisted distally; the sensory rod is longer and thinner, almost straight; the sucking seta is shorter (it barely extends beyond the apex of the leaf-like setae)



Figs.281 - 285

Fig.281 - Caloglyphus spinitarsus Herm., hypopus, dorsal surface. Fig.282 - Ditto, ventral surface. Fig.283 - C. polyphyllae, sp.n., hypopus, dorsal surface. Fig.284- Ditto, ventral surface. Fig. 285 - C. moniezi A.Z., hypopus, ventral surface.

and has a bigger "saucer". Eta is more distal in position. Le g s III and IV are also more slender than in C. polyphyllae, the setae finer, the leaf-shaped setae narrower. Length 300 to 362μ (according to Vitzthum 1924). Length 224 to 392μ and width 190 to 210μ.

Habitat. France, Holland, Germany, U.S.S.R. (suburbs of Moscow, Volhonskoe and Smolensk).

Ecology. C. moniezi is biologically associated with the cockchafer, Melolontha - which serves as host for the hypopus and after death is used as a feeding substrate for other stages.

8. Caloglyphus sphaerogaster A.Z. (Figs. 274 to 277, 279, 286, 296.) Zachvatkin, 1937, 186, figs. 15 to 24.

This differs from all other species, except C. mycophagus, in lacking sexual dimorphism. The proportions of the body, the legs and their chaetotaxy, the relative lengths of the setae of the idiosoma are practically the same in both sexes; the actual lengths are much the same. The hysterosoma is much distended, narrowing slightly behind sa i and terminating in a narrow, slightly rounded, posterior edge; its width is 1.3 to 1.5 times less than the total length of the idiosoma. The pseudostigmatic organ is a very small (3 to 5μ), cylindrical rod, which is slightly pointed at its end. The dorsal setae of the hysterosoma are short, thick, almost conical; the posterior edge of the propodosomal shield is straight or feebly convex; the lateral surface of the propodosoma around trochanter I, as well as the wide, irregularly shaped areas around the sternum and epimeres, are strongly cuticularised and reddish brown in colour. The setae of the idiosoma are short, fairly thin and flexible, the long ones have thickened bulbous bases. The lengths of the setae in proportion to the length of the idiosoma in both sexes are - v i 9 to 10, sc e 30 to 33, sc i 7 to 8, h e 20 to 25, h i 3 to 4, d_1 2.5 to 4, d_2 5 to 6, d_3 12 to 21, d_4 16 to 20, l a 3 to 5, l p 13

to 17, sa e 3 to 5, sa i 15 to 20%. The legs are strongly pigmented, slender and long; they appear thin in comparison with the excessively bloated body; in the ♂ their lengths are 32 to 35 (I, II), 30 to 32 (III), 33 to 37 (IV) % of the length of the idiosoma; in the ♀ , owing to the greater distension of the body, they are 3 to 4% shorter, but actually they have the same proportions as in the ♂. The sickle-shaped setae of tarsi I and II terminate in a moderately wide plate, which is slightly narrower on tarsi III and IV; two of these setae are present on tarsi IV; the sensory rods of tarsi I and II are thin and cylindrical.

♂. Only the homeomorphic form is known. P_2 equal p_1 and are represented by thin microsetae; the distance between the p_2 setae is half that between the p_1 setae. The anal copulatory suckers are oval and feebly cuticularised, sharply outlined posteriorly by connecting sclerites; anteriorly their outlines are feeble; a line drawn through the connecting sclerites and the posterior edges of the suckers passes slightly anterior to the back edge of the anal slit; the length of the anus is 3 times that of the suckers. The distal part of the penis is straight and very thin. Length 900 to 1,000μ, width 600 to 690μ.

In all, there are 4 pairs of anal microsetae; of these 2 are placed at the anterior end of the anal slit, one in the middle and one at half the distance between this middle pair and the posterior end of the anus. The genital suckers and edges of the anal slit are reddish brown. Length 1,180 to 1,225μ, width 775 to 930μ.

The eggs have a very thick brown chorion, in size they are 130 to 160 x 75 to 100μ; the number of eggs developing simultaneously in the ♀ may reach 25. The hypopus and other stages are unknown.

Habitat. This has been found once in the suburbs of Moscow in rotting onions infected with R. echinopus, Anoetus and their accompanying laelaptid predators.

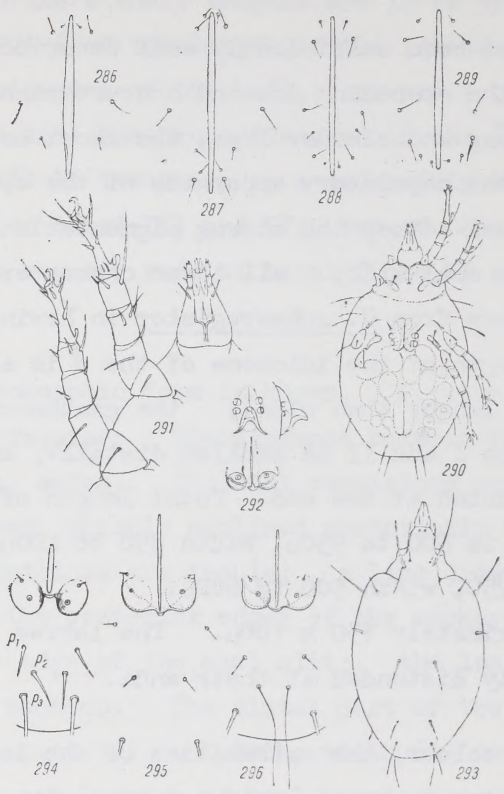
9. Caloglyphus mycophagus Mégn. (Figs. 290 to 292, 316, 356, 357.)

Mégnin, 1874, Journ. Anat. Physiol. X, 235, t. VII to IX (Tyroglyphus).

This species has not been sufficiently well described; without doubt, it is allied to the preceding one and characterised by the absence of sexual dimorphism, long and slender legs, the short setae of the idiosoma, the structure of the copulatory apparatus of the ♂, the distribution and length of the postanal setae, the strong pigmentation of the genital suckers and edges of the anal slit; all these characters are common to both species. It differs from C. sphaerogaster in having a less spherical hysterosoma (the length of the idiosoma of the ♂ is almost twice, and that of the ♀ 1.6 times longer than wide); the gnathosoma is narrower, the sensory rod of tarsus I and II is swollen distally, and the penis is bent like a hook and blunted at the end. Total length of the body, including the gnathosoma, is 800 to 950μ, width 350 to 400μ; the length of the ♀ is 1,000 to 1,250, width 500 to 600μ.

The eggs are approximately 150 x 100μ. The larvae have large "brustst iele", moderately distended at their ends.

Hypopus. Pale pink in colour, the extremities of the legs being a dark wine colour. The idiosoma is broad, only 1.3 times longer than wide. The propodosomal shield is one-tenth of the hysterosoma in length, with an obtuse angled, anteriorly projecting rostrum, and distinctly concave lateral edges; the latter are broadly concave and of a shape that is peculiar to this species. The arrangement of sc has not been established; v i are placed on the apex of the rostrum; h e, sa i and p are long, particularly the latter. In Mégnin's drawing (fig. 2, IX) which is reproduced here, they are all represented as having the same length as the tibia and genu taken together. The distal half of the bifurcation of the gnathosoma projects beyond the rostrum; the basal segment is square, with a concave depression in the middle of the anterior edge; the branches of the bifurcation are long (almost the same length as the basal segment), widely apart, with 2 segments which are clearly separated



Figs. 286 - 296.

Fig. 286 - Caloglyphus sphaerogaster A.Z., anal slit of ♀ and setae. Fig. 287 - Ditto, C. mandzhur, sp.n. Fig. 288, 289 - Ditto, C. rodionovi A.Z. Fig. 290 - C. mycophagus Mégnin, ♀, ventral surface (after Mégnin). Fig. 291 - C. mycophagus Mégnin, legs I and II, gnathosoma, ventral surface (after Mégnin). Fig. 292 - C. mycophagus Mégnin, copulatory apparatus of ♂ ; above right, penis, lateral view. (after Mégnin). Fig. 293 - C. berlesei Mich. ♀, dorsal view (after Berlese). Fig. 294 - C. polyphyllae, sp.n., anal slit of ♂ with copulatory suckers and postanal setae. Fig. 295 - Ditto, C. rodionovi A.Z. Fig. 296 - Ditto, C. sphaerogaster A.Z.

from the basal one. The sternal shield is feebly cuticularised, outlined by an arched line, which is interrupted in the middle; the sternum and epimeres II are well-defined, the latter having à sharp edge bent externally; coxal fields III are very distinctly outlined and separated from each other, as well as from the well-outlined coxal fields IV, by a wide, elongated space; the genital shield is clearly separated from coxal fields IV. The sternal suckers are replaced by fairly long strong setae; the genital suckers are closely apposed to the genital slit. The anterior suckers of the sucking disc are noticeably smaller than the lateral and posterior ones, which are themselves only slightly smaller than the central ones; the lateral suckers are placed somewhat anterior to the central.

The legs are fairly long and slender; their lengths, expressed as percentages of the length of the idiosoma, are - 40, 35, 21, 30. Almost the whole of legs I and II protrude beyond the anterior edge of the propodosomal shield,. their tarsi are approximately 3 times longer than their diameter in the middle. The ventro-lateral setae of the genu and tibia are thin, not thickened into spines; the sensory rods of tarsi I and II are very conspicuous, with strong thickened, orb-shaped ends; the sharp, sickle-like claws are also prominent. Length 300 to 330μ, width 220 to 240μ.

Habitat. It has only been recorded, with certainty, from France.

Ecology. It was found in colonies inside cavities which are made at the base of mushroom stems. The hypopi are sometimes found on fresh mushrooms, but exist in greater numbers on decomposing or desiccated remains; they are frequently found on various small beetles, millipedes, and spiders which serve as transporters. The females lay eggs, the number unknown, but it is probably a large one, as 12 eggs can develop at the same time. According to Mégnin's observations, the females only copulate in the telonymphal stage. In 1937 I pointed out that under the name of Tyroglyphus or Caloglyphus mycophagus were included all the species of Caloglyphus and even some Acotyledon (A. alberti, A. krameri); when

the well-described drawings of Mégnin are studied, it is easy to be completely convinced that the species, which he investigated, clearly differs in all stages of its development from the numerous forms which have been described by later authors under the same name.

10. Caloglyphus geotruporum sp.n. (Figs. 266, 267, 307, 308.)

Hypopus. K. Dujardin, 1849, Ann. Sci. Nat. Zool. (3), XII, 263.

This has only been found in the hypopial form; it differs from that of all other species of Caloglyphus in its small size and whitish colour. The idiosoma is 1.5 times longer than its maximum width and broadly oval; the propodosomal shield is triangular, with slightly protruding anterior lateral edges and an oval rostrum, which is slightly less than half the length of the hysterosomal shield, v i arise from the apex of the rostrum. The hysterosomal shield has a completely straight anterior edge, the transverse striations on its anterior part are very faint, the rest of the surface being smooth and structureless. The gnathosoma is completely hidden beneath the restrum, its arists protruding beyond it; it is egg-shaped, non-segmented, only slightly divided terminally. The sternal shield is indefinite in shape, soft and membranous; epimerites II are almost transverse, hardly noticeable, feebly marking the arched boundary between the propodosoma and the hysterosoma; epimeres II converge at an obtuse angle, they are slightly arched and have wide apodemes; coxal fields III are well-outlined, separated by a narrow longitudinal space; coxal fields IV are barely differentiated. The coxal and genital suckers are small and normal in structure; the sucking disc is fairly large; the posterior and lateral suckers are small (their diameter is 3 times less than the diameter of the central ones) and arranged in an arc.

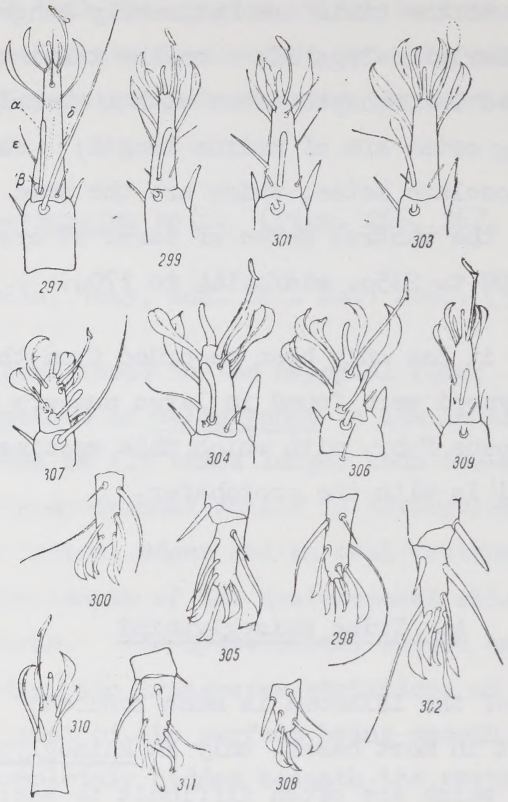
The legs are short and fairly massive; the anterior 2 pairs are approximately the same length; the tarsi are short, less than twice as long

as their diameter; the ventral setae of the femur are short; the ventro-lateral setae of the tibia are noticeably longer than the external ones, particularly on legs II; on the tarsi there are 4, very wide, strongly twisted leaf-shaped setae with a clearly defined middle "vein"; the sucking setae are of medium length; on tarsi III there are 6, on tarsi IV 4 lanceolate setae, which are the same shape as those on the anterior legs; the ventral setae of tarsi IV are short, thick and straight. Length 200 to 235μ, width 144 to 170μ.

Habitat. Up to now it has only been recorded from the U.S.S.R., France and Germany. The hypopi were found in large numbers beneath the elytra of Geotrupes stercorosus Fabr. with which this species is probably connected, as C. moniezi is with the cockchafer.

4. Tribe Rhizoglyphini

The chaetotaxy of the idiosoma is much reduced; v e, sc i, d_1 to d_2 and l a are absent in most cases, only in Rhizoglyphus are they represented by microsetae which are often difficult to see; in the majority of species, d_3 and s h are also absent, and in some (Histiogaster, Schwiebia), sa e as well; the idiosoma then bears 6 to 7 pairs of setae. The legs are usually short and massive, the praetarsus strongly reduced, the claws usually large and massive (particularly on legs I and II); on leg I there is only 1 basal sensilla (delta), sometimes it is absent; sensilla eta is placed immediately in front of the sensory rod and is usually represented by a conical spine; the middle apical seta - beta - is more or less thickened and is usually shaped like a narrow plate bent towards its end. Sexual dimorphism is almost always very pronounced and in most males (except those belonging to the genera Rhizoglyphus and Heteroglyphus), the opisthosoma is strongly modified and lobed; in addition, the dorsal surface is sclerotised and coloured, forming a distinct opisthosomal shield separated from the surrounding soft skin. The apical seta of tibia IV is modified into a hollow conical spine; legs IV are sometimes



Figs. 297 - 311. Genera Caloglyphus and Rhizoglyphus. Chaetotoxy and structure of legs of hypopi.

Fig. 297 - Caloglyphus rodionovi A.Z., tarsus and tibia I, dorsal view. Fig. 298 - C. rodionovi A.Z., tarsus IV, ventral view. Fig. 299 - C. tshernyshevi, sp.n., tarsus and tibia I, dorsal view. Fig. 300 - C. tshernyshevi, sp.n., tarsus IV, ventral surface. Fig. 301 - C. mandzhur, sp.n., tibia and tarsus I, dorsal surface. Fig. 302 - C. mandzhur, sp.n., tibia and tarsus IV, ventral view. Fig. 303 - C. moniezi A.Z., tarsus and tibia I, dorsal surface. Fig. 304 - C. polyphyllae, sp.n., tibia and tarsus I, dorsal surface. Fig. 305 - C. polyphyllae, sp.n., tarsus IV, ventral surface. Fig. 306 - C. spinitarsus Herm., tibia and tarsus I, dorsal surface. Fig. 307 - C. geotruporum, sp.n., tibia and tarsus I, dorsal view. Fig. 308 - C. geotruporum, sp.n., tarsus IV, ventral view. Fig. 309 - Rhizoglyphus echinopus F and R, tibia and tarsus I, dorsal surface. Fig. 310 - R. echinopus F and R, ditto, ventral view. Fig. 311 - R. echinopus F and R, tarsus IV, ventral surface.

more or less strongly thickened. In addition, in many species, the general shape of the body in the ♂ is very different from that of the ♀. In the ♀, the posterior end of the body is normally shaped and the opisthosomal shield is absent; also the apical seta of tibia IV is not modified and legs IV are never thickened. The copulatory apparatus and anus of the ♂ are usually much displaced posteriorly; in most cases the whole of the circumference of the anal copulatory suckers is thickly cuticularised; the 1 to 3 pairs of postanal setae are often (Rhizoglyphus) represented by microsetae; the tarsal copulatory suckers are usually in the distal half of the segment, they are large and sometimes placed obliquely opposite each other. In the ♀ the anus is much displaced posteriorly, and may occupy an almost terminal position; there is only one pair of adanal setae. In nymphal stages, v e, sc i, h i, sh, d_1 to d_3 and l a are always absent.

The tribe Rhizoglyphini, whose characters are given above, includes 15 palearctic species, which fall into the following 6 genera - Rhizoglyphus Clap. 1869, Heteroglyphus Foa 1913, Schwiebia Ouds. 1916, Histiogaster Berlese 1883, Monieziella Berlese 1897 and Thyreophagus Rond. 1874. As can be seen from this list, my tribe Rhizoglyphini does not correspond with the family Rhizoglyphidae Ouds. 1923, nor to any other group erected by Oudemans. The genera which I have now placed in the tribe Rhizoglyphini were placed by him in 2 different families - the Caloglyphidae Ouds. 1932 (genera Histiogaster and Monieziella) and the Rhizoglyphidae Ouds. 1923 (genera Rhizoglyphus and Schwiebia); on the other hand, I do not include the genera Sancassania Ouds.1916 and Garsaultia Ouds.1916 in my group, these were placed by Oudemans near the genus Rhizoglyphus and, as they are known only in the hypopial form, it makes it impossible to judge their correct systematic position.

Genus Rhizoglyphus Clap.

Claparède, 1869, Ztschr. wiss. Zool. XVIII, 506; Canestrini, 1888, 8; 1888a, 357; Berlese, 1896, LCCIX, No. 5; Kramer, 1899, 143; Michael,

1903, 80; Berlese, 1897, 109 - Coepophagus Mégnin, 1880, Les parasites, 144. - Hypopus Oudemans, 1901, Tijdschr. Ned. Dierk Ver., (2), VII, 2.

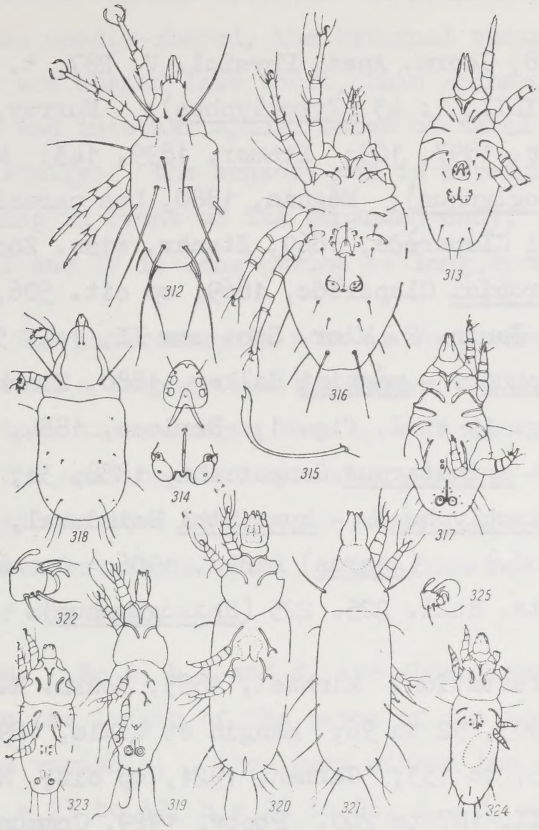
Type species: Tyroglyphus echinopus Fum. and Rob. 1868.

Secondary sexual differences are slight, v e are absent; sc i, h i, sh, d_1 to d_2 and l a are represented by microsetae (and are sometimes absent), the remaining setae are fairly short and thin; both pairs of sacrals - sa i and sa e - are well-developed; a pseudostigmatic organ is present. Epimeres III and IV are free. The legs are short and massive, with very strong spines; the external ventral setae of the genu and tibia (as well as the unpaired ventral ones on legs III and IV) and the middle ventral ones of the tarsus, are also spines; eta is a thick conical spine placed immediately in front of the sensory rod; delta is external and somewhat anterior to eta; the middle apical spine of the tarsi is straight, inclined obliquely downwards; the dorsal and all 5 ventral apical spines are very large. The claws are very big and massive, the praetarsus strongly reduced.

♂. The posterior end of the idiosoma is unmodified, with no trace of opisthosomal plate; p_1 are short, p_2 and p_3 long, arranged in an arched transverse row. A heteromorphic form occurs, but it is not so plentiful as the homeomorphic.

♀. Besides the one pair of fairly long postanal setae, there are another 3 pairs of adanal microsetae; in the nymph, sc i, h i, d_1, d_2 and l a are absent.

The larvae have large orb-shaped "bruststiele" and longer d_3 and l a than in any other stage. A hypopus is formed. In the genus Rhizoglyphus I can only place with certainty 1 palearctic species - Rhizoglyphus echinopus F. and R.; the greatest number of species belonging to this genus were found in Central America and tropical Asia and they require a more critical and detailed study.



Figs. 312 - 325

Fig.312 - Caloglyphus berlesei Mich., ♂ , dorsal surface, (after Berlese). Fig.313 - Ditto, ventral surface (after Berlese). Fig. 314 - C. berlesei Mich., copulatory apparatus of ♂ , (after Berlese). Fig.315 - C. berlesei Mich., sickle-shaped seta of tarsus I (after Berlese). Fig.316 - C. mycophagus Mégnin, ♂ , ventral surface (after Mégnin). Fig.317 - Schwiebia ipidis Vtz., ♂ , ventral surface (after Vitzthum). Fig.318 - S. ipidis Vtz., ♀, dorsal surface (after Vitzthum). Fig.319 - Monieziella corticalis Mich., ♂ , ventral surface (after Michael). Fig.320 - M. corticalis Mich., ♀, ventral surface (after Michael). Fig.321 - Ditto, ventral surface (after Michael). Fig.322 - M. corticalis Mich., tarsus I, ventral view (after Michael). Fig.323 - M. berlesiana, nom.n. ♂ , dorsal surface (after Berlese). Fig.324 - M. berlesiana, nom.n. ♀, ventral surface (after Berlese). Fig.325 - M. berlesiana, nom.n., tarsus I, lateral view (after Berlese).

1. Rhizoglyphus echinopus Fum. and Rob. (Figs. 87, 196 to 198, 309 to 311, 326 to 328, 337, 338.)

Fumouze et Robin, 1868, Journ. Anat. Physiol. V, 287, t. XX-XXI; Kramer, 1876, Arch. Naturg., XLII, 1: 43 (Tyroglyphus); Murray, 1874, Econ. Entomol. 257; Berlese, 1897, 109; Kramer, 1899, 143; Michael, 1903, 84, t. XXX-XXXI (Rhizoglyphus); Mégnin, 1880, Les parasites, 144 (Coepophagus). - dujardini Claparède, 1869, Ztschr. wiss. Zool., XVIII, 505, t. XXXV (Hypopus). - robini Claparède, 1869, op cit. 506, t. XXXV, figs. 7-11; Michael, 1885, Journ. R. Micr. Soc. ser II, vol. 5: 19, t. III, figs. 15-17 (Rhizoglyphus). - mégnini Haller, 1880, Ztschr. wiss. Zool. XXXIV, 273, t. IX, fig. 16 et X, fig. 1; Berlese, 1884, A.M.S., XIV, No. 7 (Tyroglyphus). - spinitarsus Canestrini, 1888, 31; 1888a, 413, t. XXXIII, fig. 1 (Rhizoglyphus). - hyacinthi Boisduval, 1867, Entomol. horticole, 86 (nom. nud.). (Acarus) Banks, 1906; Garman, 1921, Connecticut Agr. Expt. Sta. Bull. 225, 225 (Rhizoglyphus).

Biology, degree of infestation. Michael, 1885, Journ. R. Micr. Soc., ser II, vol. V, 19, 1903, 92 to 96; Mangin et Viala, 1892, C.R. Acad. Sci. Paris, CXXXIV, 151 to 153; Garman, 1921, op cit; Hodson, 1928, Bull. Entomol. Res. XIX, 187 to 200. Popov, 1929, Communications of the Kaz. Inst. of Agric. and Forestry, No. 5, 1 to 29.

The root, bulb and potato mite. A bloated, slow-moving form, varying in size, in the relative lengths of the legs and tarsi and the lengths of the setae. The idiosoma is about 1.6 times its maximum width in length, with feebly marked (in microscopic preparations) scapular projections, it gradually narrows towards its posterior end. Sc e are longer and thicker than all the other setae of the idiosoma; sc i are 10 to 15 times shorter than sc e and represented by thin microsetae, they may be absent; h i, d_1, d_2 and l a are also microsetae, 1 to 3% of the idiosoma in length (they are sometimes absent); d_3 are 2.5 to 4 times longer than d_2, and 2.3 to 3 times shorter than d_4, the latter being approximately equal to sa i in length; sa e are 1.7 to 2.5 times shorter than sa i. The

pseudostigmatic organ is shaped like a bristle, smooth and almost equal to d_3. The internal ventral setae of the tibia and basal setae of genua I and II are needle-shaped, the external ventral setae of the genua and tibiae are shaped like short, thin spines; the external and internal ventral and internal apical setae of tarsi I and II are slightly lanceolate distally; the sensory rod is straight, almost cylindrical (slightly narrowing in front of its expanded end); the dorsal apical seta of tarsi III and IV is long (twice as long, or more, than the tarsus).

♂. Dimorphic. The heteromorphic form is very rare in Russia. (I have only seen it once in a sample from the Fergan valley). P_1 are microsetae, p_2 are 5 to 6 times longer than p_1 and approximately 1.5 times less than p_3. The anal copulatory suckers are of the usual structure and without a cuticularised peripheral ring; the penis is elongated, trapezoid, with a short distal part, which does not protrude beyond the anterior edges of its base.

Homeomorphic form. Sc i, h i and d_1 are absent more often than in the ♀; on an average the length of the setae of the idiosoma is greater than in the ♀ and less variable; they vary within the following limits - v i 11 to 17, sc e 23 to 32, h e 20 to 25, d_1, d_2 and l a 1.5 to 3, d_3 8 to 10, d_4 27 to 32, l p 11 to 30, sa e 6 to 20, sa i 15 to 30, p_1 3 to 4, p_2 16 to 25, p_3 23 to 35% of the length of the idiosoma. The relatively great length of d_3, d_4 and particularly l p is characteristic. The relative lengths of the legs are very constant; they are about 30 (I, II) and 24 to 26 (III, IV) % of the length of the idiosoma. Length 380 to 725μ.

Heteromorphic form. The relative lengths of legs I and II and of the setae of the idiosoma differ less from those of the homeomorphic phase than in Caloglyphus. Legs III and IV are much longer (approximately equal in length to the anterior ones); the ventral internal apical setae of tarsi I and II are enlarged terminally into sickles, each terminating in a twisted plate; the ventral seta of the tibia of the modified leg III is shaped like a strong conical spine; the cuticularised

plates around the epimeres, especially those around coxae IV, are much better developed. Length 600 to 780μ.

♀. The setae of the idiosoma are shorter than in the ♂, their relative lengths more variable and, on the whole, inversely proportional to the size of the body; in large specimens of 1,000μ in length, the lengths expressed as a percentage of the idiosoma are v i 9 to 11, sc e 17 to 20, h e 15 to 17, h i, d_1, d_2 and l a 1.5 to 2, d_3 5 to 7, d_4 12 to 16, l p 9 to 10, sa e 4 to 8, sa i 10 to 15, p a 16 to 17; in small females (length 530 to 600μ), the lengths of the setae approximate more closely to those of the ♂, and are - v i 15 to 16, sc e 28 to 32, h e 23 to 32, h i, d_1, d_2 and l a 2 to 3, d_3 6 to 8, d_4 20 to 35, l p 12 to 15, sa e 6 to 14, sa i 20 to 27, p a 20 to 25% of the length of the idiosoma. The same principle is shown by the relative lengths of the legs, which in large females are 21 to 24 (I, II) and 16 to 17 (III, IV), and in smaller ones 28 to 30 (I, II) and 20 to 22 (III, IV) % of the length of the idiosoma. Length 530 to 1,100μ.

Larva. D_3 and l a are approximately equal in length to the caudal setae (sa i), i.e. they are relatively much longer than in the adult stage; the "bruststiele" are 3.5 times longer than their greatest diameter, and have a small, almost spherical, apical dome.

Hypopus. Morphologically, this closely resembles hypopi of the genus Caloglyphus (particularly C. moniezi and C.polyphyllae), from which it differs in having a plate-like rostrum, which projects anteriorly as a semicircle, and is covered dorsally with irregular punctuations. It is dark, dirty brown in colour. The idiosoma is elliptical, 1.5 to 1.6 times longer than its width; the cuticle is dense and strongly cuticularised. The propodosomal shield is 3 to 3.5 times shorter than the hysterosomal, with a broad, semicircular rostrum, which is separated by well-defined indentations from the rounded, anterior lateral corners of the shield; the rostrum is covered with distinct irregular punctuations. The remainder of the surface of both shields (except for the usual striated

line along the anterior edge of the hysterosomal shield) is quite smooth; all the setae of the dorsal surface are very short. The gnathosoma is completely hidden beneath the rostrum, except for the distal half of the arists, its basal segment, about 1.5 times longer than its width at the base, narrows perceptively towards its somewhat deeply cleft end; the distal segments lie close together and are 2.5 to 3 times shorter than the basal one. The sternal shield is well-defined, with a straight posterior edge and slightly concave sides; the sternum and epimeres II do not nearly reach its posterior edge and coxal fields I and II are open; coxal fields III are fairly well-defined; the genital shield is clearly separated from coxal fields IV. The coxal suckers are small and normal. The sucking disc is of medium size, like that of Caloglyphus; all the peripheral suckers are the same length.

Legs I and II are short and massive, of variable proportion; the tarsi are 2 to 2.5 times longer than their diameter at the base; the ventro-lateral setae of the tibia and genu are straight and of medium size; the tarsi have 3 large and 2 small leaf-shaped setae bent into an arc distally; the middle ventral seta of the tarsus resembles a short blunt spine; the sucking seta has a narrow "saucer"; the sensory rod is almost straight and slightly thickened distally; delta is absent and eta is a thick blunted seta. The ventral setae of tibiae III and IV are spine-like; the apex of each tarsus has 4 lanceolate setae, in addition, on tarsus III one of the basal setae has a similar shape (the other resembles a spine); the dorsal seta of tarsus IV is not longer than the tarsus itself. Length 250 to 370μ.

Habitat. Cosmopolitan; the northern limit of its distribution in the palearctic zone is not known.

Ecology. It lives on onion, lily, narcissus, hyacinth, tulip, orchid and other bulbs; potato and dahlia tubers, beetroot and other vegetables, on the roots of vines, wheat, oats and a whole series of cultivated plants, either in storage or in the field; it has also been found on fallen fruit, in forest litter and on mushrooms; sometimes it is

found on grain which has a high moisture content. This species likes a high humidity and develops well in a liquid medium. Its optimum temperature is 23 to 26°C., but it will breed at a room temperature of 6 to 10°C. The life history is completed in 17 to 27 days at 18.3 to 23.9°C., in 9 to 13 days at 20 to 26.7°C. The hypopi are usually carried by Diptera, which develop in the same habitat as the mite, e.g. Scatopse, Phorbia, Chortophila, the onion fly Eumerus and some beetles. R. echinopus is recognised as a serious pest of decorative bulbs, onions, potatoes and other tuberous plants; it is particularly destructive during the time of storage and sometimes causes great economic loss.

11. Genus Heteroglyphus Foà.

Foa, 1909, Atti Accad. Lincei Roma, Rendic (5), 18, II, 653.

Only one species is known.

1. Heteroglyphus vitium Foà.

Foà, 1909 (see above).

This little known species was recorded by Foà in 1909 in her biological work on the mites damaging the roots of vines and grapes, and has not been described in further detail. Judging by the characters which are given in this work, H. vitium resembles R. echinopus in its habits and is found with it. The males are easily distinguished by the thickened fourth pair of legs, but the females are not easily recognised; according to Foà, they differ in having legs III and IV of equal length, whereas in R. echinopus legs III are considerably shorter than legs IV.

Habitat. Italy, on grape vine roots with R. echinopus F. and R.

12. Genus Histiogaster Berl.

Berlese, 1883, Riv. period. lav. R. Acad. Padova. XXXVIII, 45; 1897, 100. Tyroglyphopsis Vitzthum, 1926, Zool. Jahrb., Syst. XLII, 476.

Type species: Histogaster silenus nom.n.

The proportions of the idiosoma are variable. V e, sc i, h i, d_1, d_2, l a and sa e are absent. All the rest (sc e, h e, d_3, d_4, l p and sa i) are macrosetae (25 to 60% of the length of the idiosoma). The legs are of medium length, fairly long and relatively slender; the middle ventral seta of the tarsus is a massive conical spine; eta is a similar spine placed directly in front of the sensory club; the middle apical seta of tarsi I and II is S-shaped, the outer one is moderate in length. The claws are large and massive, the praetarsus completely reduced. The morphological differences between the sexes is marked.

♂. Only the homeomorphic form is found. The posterior end of the idiosoma is produced into a horizontal, strongly cuticularised opisthosomal shield, which is sharply narrowed at the base; the free edge of this plate forms 4 semicircular festoons, bearing 4 large, completely transparent, leaf-like flanges, arranged fanwise; the anal suckers are strongly cuticularised, ending obliquely and with a characteristic chitinised grid in the middle; p_1 is a microseta, p_2 and p_3 are absent (evidently they are homologous with the leaf-like flanges described above). Legs IV are markedly thickened.

♀. The posterior end of the idiosoma is not modified. Legs IV are not thickened; only 1 pair of anal setae, and the postanal, is present. The larva has a definite chaetotaxy and small spindle-shaped "bruststiele".

Hypopus. The idiosoma is egg-shaped, with a smooth (very finely pitted), moderately arched dorsal surface; all its setae are microsetae (sometimes p a are very long); sc are arranged in a trapezium; sa i are

slightly external to the others. The propodosomal shield is 2.5 times shorter than the hysterosomal, with a rounded rostrum. A pair of well-developed (but lacking clearly defined lenses) separate eyes is placed on the apex of the rostrum. The pseudostigmatic organ is absent. The excretory opening of the "fatty" glands is lateral, almost level with 1 a. The gnathosoma is 1.5 to twice as long as its width, and forked at the end. Epimerites II extend longitudinally as far as the external edge of acetabula III, or are only faintly marked; owing to this, the sternal shield is not separate, but with the ventral, forms an unbroken structure; the epimeres of all pairs of legs are free and widely separated at their ends. Epimeres III are bent cornerwise, IV are almost straight; the entire surface of the single sterno-ventral shield is evenly sclerotised, without conspicuous thickenings of the edges. The sucking disc is large, with the usual 4 pairs of suckers (of which the outer and posterior ones are of equal size and arranged in an arc, which is concave anteriorly); it is displaced posteriorly. The auxiliary (angular) suckers are not differentiated, the genital are very widely separated.

The legs are moderate in length, or fairly long, I and II protrude almost completely beyond the edges of the idiosoma; the ventro-lateral setae of the tibia and genu and the basal setae of the genu are short or medium in length, smooth and sometimes, almost spine-like; the apex of genu I has only 1 seta; on tarsus I sensilla delta is almost completely displaced to the base of the sensory rod; sensilla eta is shaped like a bristle; the sucking seta is thin with a small narrow "saucer". The claws are long and less hook-shaped than usual.

Five palearctic species are known, of which two have only been described from the hypopial form (these were placed by Vitzthum in 1926 in a separate genus Tyroglyphopsis). All the representatives of this genus known in the adult stage have, up to now, been considered as 1 species.

Histiogaster Berl.

Males

1(2) The length of the opisthosomal plate equals its basal width and is only 1.5 times smaller than its maximum width; the transparent folds of the fan are appreciably longer than wide; penis relatively small; the anterior legs are separated from the posterior by a great distance (M. carpio Berl. 1883, not Kramer 1881). Italy.

3. H. silenus nom.n.

2(1) Opisthosomal plate nearly twice as short as wide at its base; transparent folds of the fan not longer than their width; penis very large; distance between the anterior and posterior legs moderate.

3(4) Idiosoma widely oval, 1.5 to 1.65 times longer (including the opisthosomal plate) than wide; transparent folds of the fan completely separate; festoons divided by fairly deep depressions. Germany, U.S.S.R. (Caucasus, Abrau-Dursau).

1. H. bacchus sp.n.

4(3) Idiosoma elongated, more than twice as long as wide; transparent folds of the fan joined at the base, forming an uninterrupted border with 4 lobes, around the opisthosomal plate. The festoons of the latter touch at their bases. Germany.

2. H. carpio Kram.

Hypopi

1(2) Gnathosoma 1.5 times longer than wide at its base, shaped like an elongated trapezium; epimerites II separated by a space from acetabula III, at their ends each is produced into a thin wavy appendix, directed anteriorly; p a very long (nearly 25% of the length

of the idiosoma). Legs III and IV 28 to 30% of the length of the idiosoma, with very long macrosetae; anal suckers much larger than the lateral and posterior. Germany, U.S.S.R. (Caucasus, Abrau-Dursau).

1. H. bacchus sp.n.

2(1) Gnathosoma 2 to 3.5 times longer than wide, with parallel sides; epimerites II joined at their ends with the external edge of acetabula III; epimerites III without a wavy appendix (p a very short, not exceeding 10% of the idiosoma); legs III and IV 22 to 24% of the length of the idiosoma; macrosetae of tarsi III and IV short, anterior suckers the same size as the laterals, or smaller.

3(4) Ventro-lateral setae of tibiae and genua I and II thin, not shaped like spines; dorsal apical seta of genua very long, like that of the tibiae; ends of epimeres II curved externally; coxal suckers fairly large; eyes placed in the longitudinal axis of the body, their edges are parallel along their entire length. U.S.S.R. (Vladivostock).

4. H. filippovi sp.n.

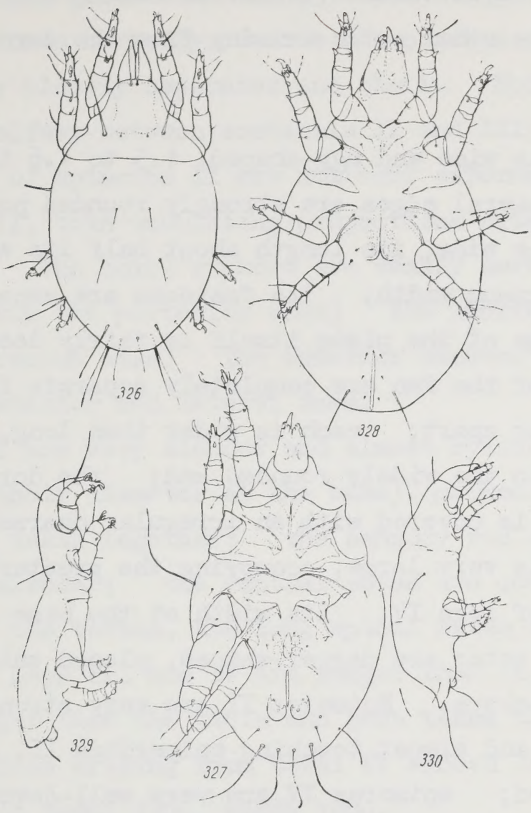
4(3) Ventro-lateral setae of tibiae and genua I and II shaped like short, strong spines; apical-dorsal seta of genua short; ends of epimeres II converging, not recurved externally; coxal suckers very small; eyes placed obliquely, nearly united anteriorly at their ends and diverging widely behind. Brout-Vernet (France).

5. H. ocellatus Vitzthum

1. Histiogaster bacchus sp.n. (Figs. 18, 198, 331 to 333, 339.)

Carpio Zacher, 1927, 270 (non Kramer 1881).

Idiosoma moderately long and wider in males than in females, the posterior pair of legs are separated by a short distance from the anterior



Figs.326 - 330

Fig.326 - Rhizoglyphus echinopus F and R., homeomorphic ♂, dorsal surface. Fig.327 - R. echinopus F and R, heteromorphic ♂, ventral surface. Fig.328 - R. echinopus F and R, ♀, ventral surface. Fig. 329 - Schwiebia tshernyshevi, sp.n., heteromorphic ♂, lateral view. Fig.330 - Thyreophagus entomophagus Lab. ♂, lateral view.

ones, so that epimeres III and epimerites II are nearer to each other, than epimerites II are to epimeres II. The legs are fairly long, the external ventral seta of tibia I and II is needle-shaped. D_3 are shorter than all the other setae arising from the dorsal surface of the hysterosoma.

♂. The idiosoma is wide and egg-shaped, 1.5 to 1.6 times longer than its width; its lateral edges are strongly rounded posteriorly. The gnathosomal plate is wide, its length about half its width at the base, and a third its maximum width; its festoons are separated by wide spaces, and the edge of the plate itself is fairly deeply excised; the transparent edges of the fan are completely separate from one another, with their bases far apart; each is wider than long, noticeably widening from the base to the widely rounded end; the dorsal slope of the opisthosomal plate is covered with an irregular coarsely pitted sculpture; the penis is very large, occupying the greater part of the space between the bases of legs IV; its width at the base is greater than its length; the anal setae are dagger-shaped, placed anterior to the central part of the suckers. Epimeres II are very strong, their ends bending externally and almost touching epimerites II, so that coxal fields II are almost closed; epimeres IV are very well-developed. Internal to the apical spine of tibia II, there is a small protruberance. Total length of the body is 420 to 515μ; the length of the idiosoma (including the opisthosomal plate) is 370 to 400μ; width 230 to 270μ.

♀. The idiosoma is 1.8 to 1.9 times longer than its width, narrowing markedly posteriorly, with more or less convex edges. The epimeres are fairly powerful; the legs are slightly shorter than those of the ♂; the anal slit is fairly long.

Hypopus. A light, dirty-brown in colour. The widest part of the idiosoma is at the scapular region; it becomes narrowed posteriorly more abruptly than in other species. The setae of the dorsal surface are fairly short and thin; p a are extremely long, like hairs. The eyes

are represented by a pair of longitudinal oval protrusions, separated by a very narrow transverse space, the cornea of each eye is pierced by very many pores. The gnathosoma is 1.5 times longer than the width at the base, and it widens markedly towards its posterior end; the distal segments are fairly clearly separated and short. Epimerites II are very short, extending halfway between acetabula II and III; the sternum is short and the ends of epimeres II are not bent externally; from the ends of epimeres III, thin undulating projections extend anteriorly, one from each epimere. The coxal suckers are weakly developed and barely visible, particularly the posterior ones; the sucking disc is surrounded by a wide membranous edge; the anterior suckers are considerably larger than the posterior and lateral ones.

Tarsi I and II are very slender and almost cylindrical (4 or 4.5 times longer than their diameter at the base), markedly longer than the 2 preceding joints taken together; the sensory rod and sensilla delta are long and very slender; the ventral setae are considerably displaced towards the end of the tarsus, the long apical setae are also very long and not widened. Legs III and IV are longer than in other species; the tarsi are much longer than the tibia and genu taken together, with very long macrosetae (those arising from tarsi IV exceed 70% of the idiosoma in length). Length about 270μ, width 180μ.

Habitat. It has only, with certainty, been recorded from the U.S.S.R. and Germany; material used for describing this species was obtained from samples from the Caucasus (from the Soviet Agricultural Council, Abrau-durso).

Ecology. It was found in oak wine barrels; according to Zacher, it was found in large numbers in wooden shavings used in the manufacture of vinegar; it influences the process of fermentation of the vinegar and has to be regarded as a pest.

2. Histiogaster carpio Kramer.

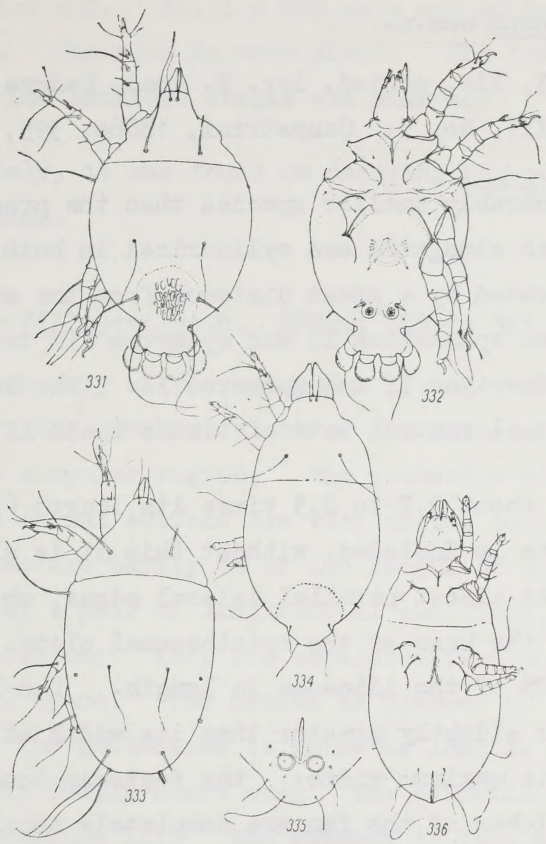
Kramer, 1881, Zool. Anz., IV, 619; Arch Naturg., XLVIII, 1, 183, t. XIII, figs. 5 to 10 (Tyroglyphus).

This is clearly allied to the preceding species, but differs in having a narrower idiosoma (especially in the ♂), shorter legs, in the length of the setae of the idiosoma and in the structure of the opisthosomal plate of the ♂.

♂. The idiosoma is elongated and egg-shaped, narrowing towards the posterior end from the level of l p; it is about 2.2 times longer than its width (the length of the idiosoma, excluding the opisthosomal plate, is twice the width). The lengths of the setae of the dorsal surface of the idiosoma, expressed as percentages of its length, are (according to fig. 6 of Kramer) - v i about 18, sc e 30, h e 24, d_3, d_4, l p and sa e about 35. The opisthosomal plate is shaped like that of H. bacchus, but the transparent lobes of its fa n merge together at the base, to form a 4-lobed edge. The base of the penis is almost the same length as its width. The epimeres are normal in structure; epimerites II are parallel to epimeres II. The total length of the body (including the opisthosomal plate with its protrusions and the gnathosoma) is 450μ; the width of the idiosoma is 200μ.

♀. The idiosoma is 2 to 2.1 times longer than its width, with almost parallel lateral edges and a widely rounded posterior end; the length of the setae of the dorsal surface are similar to those of the ♀ of H. bacchus. but d_3 (as in the ♂) are longer; according to Kramer's fig. 5, their lengths, expressed as percentages of the idiosoma, are as follows - sc e 36, h e 30, d_3 40, d_4 35, l p and sa e 36 to 38. The anal slit is long. The total length of the body, including the gnathosoma, is 520μ, the length of the idiosoma is 500μ, its width 250μ. The hypopus is unknown.

Habitat. It has been recorded from Germany (the exact place is not



Figs.331 - 336

Fig.331 - Histiogaster bacchus, sp.n., ♂ , dorsal surface. Fig.332 - Ditto, ventral surface. Fig.333 - H. bacchus, sp.n., ♀, dorsal surface. Fig.334 - Thyreophagus entomophagus Lab., ♂ , dorsal surface. Fig.335 - Th. entomophagus Lab., posterior region of ♂ , ventral view. Fig.336 - Th. entomophagus Lab., posterior end of body, ♀ , ventral surface.

mentioned). It was found in large numbers on decaying wood.

3. Histiogaster silenus nom.n.

Carpio, Berlese, 1883, Riv. period. lav. R. Acad. Padova, XXXVIII, 45, t. I. 1884, fasc. XIV, No. 5; Canestrini, 1888a, 395, t. 35, fig. 2.

This is a considerably smaller species than the preceding one. The small idiosoma is much elongated and cylindrical in both sexes; the posterior legs are separated by a great distance from the anterior ones, so that the space between epimerites II and epimeres III is much greater than that between epimerites II and epimeres II. The legs are relatively short; the external ventral seta of tibiae I and II is like a spine.

♂. The idiosoma is about 2.2 to 2.3 times its length (if the length of the opisthosomal plate is included, without this it is slightly less than twice its width), with almost parallel lateral edges, which gradually become rounded towards the base of the opisthosomal plate. Sc e, l p, d_4 and sa e are about 50% of the idiosoma in length. The length of the opisthosomal plate is slightly greater than its width at the base, and $1\frac{1}{2}$ times less than its maximum width; the festoons touch at their bases and the transparent lobes of the fan are completely separate from one another, except at their bases; their free ends are radially spread and their length is approximately 1.5 times greater than their width; they do not become narrower towards the base and their free ends are parabolically rounded. The penis is small and occupies a small part of the area between the bases of legs IV; the width of its basal struts is considerably less than the length. The anal setae are shaped like daggers and are placed on the same level as the central part of the sucker. The epimera are normal in structure and size. The lengths of the legs (according to Berlese's drawing) are 33 (I, II), 30 (III), 28 (IV) % of the length of the idiosoma. The total length of the body (including the gnathosoma and opisthosomal plate) is 300μ.

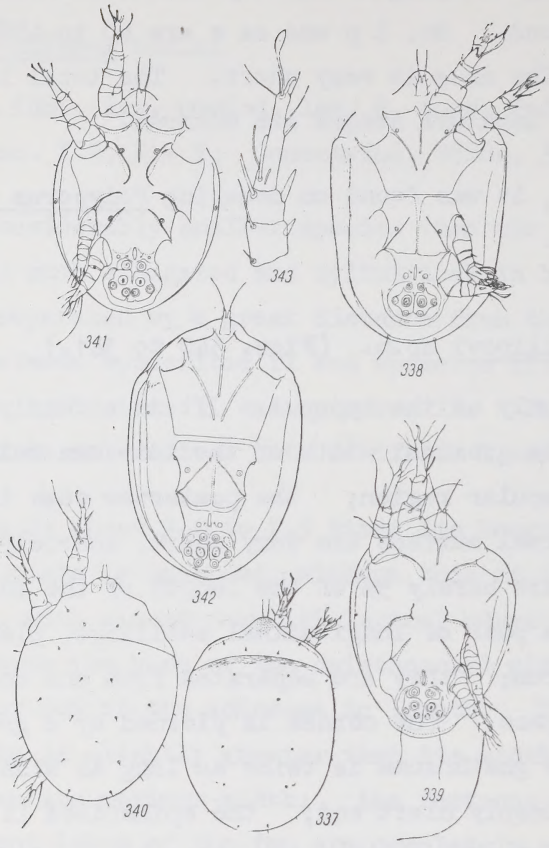
♀. The idiosoma is slightly more than twice its width, with slightly convex lateral edges, becoming noticeably narrower towards an almost truncate posterior end. Sc, l p and sa e are 40 to 45% of the length of the idiosoma. The anus is very short. The total length of the body is 350μ. The immature stages are unknown.

Habitat. In Italy, it was found on decaying Polyporus gelsrum and on decaying vine stems.

4. Histiogaster fillipovi sp.n. (Figs. 340 to 341.)

This is known only as the hypopus. It is a fairly dark, brownish-yellow in colour, the greatest width of the idiosoma being considerably posterior to the scapular region; the posterior edge is widely rounded. The setae of the dorsal surface are very short, scarcely noticeable; the postanal setae are barely 5% of the length of the idiosoma. The eyes are represented by a pair of longitudinal swellings, placed on the dorsal surface of the rostrum; they are separated from one another by a fairly wide longitudinal space. The cornea is pierced by a great number of tubular pores. The gnathosoma is twice as long as wide, with parallel sides and a fairly deeply cleft end; the epimerites II reach to the outer edge of acetabula III; the sternum is long and the ends of the epimeres II are sharply bent externally; epimeres III have no undulating appendix and there are no traces of a long ventral suture. The coxal suckers are large, particularly the sternal ones; the sucking disc is very clearly encircled by a broad membranous border and the peripheral suckers are nearly equal in size.

Tarsi I and II are fairly massive, gradually narrowing distally and rather shorter than the tibia and genu taken together; the sensory rod and sensilla delta are fairly short and massive, the latter noticeably anterior to the sensory rod. Legs I and II are fairly short, only the tarsus protruding beyond the edge of the body; the ventral setae of the tibia and genu III and tibia and femur IV are thin and short, not thickened to form spines; the dorsal seta nearest to the base of tarsus III



Figs.337 - 343

Fig.337 - Rhizoglyphus echinopus F and R, hypopus, dorsal surface. Fig.338 - Ditto, ventral surface. Fig.339 - Histiogaster bacchus, sp.n., hypopus, ventral surface. Fig.340 - H. filippovi, sp.n., hypopus, dorsal surface. Fig.341 - Ditto, ventral surface. Fig. 342 - Schwiebia tshernyshevi, sp.n., hypopus, ventral surface, (legs not shown). Fig.343 - S. tshernyshevi, sp.n., hypopus, leg I, dorsal view.

is 15%, that on tarsus IV 25% of the length of the idiosoma; all these tarsal setae are capilliform and not broadened distally. Length 242μ, width 183μ.

Habitat. It has only been found in the neighbourhood of Vladivostock, on a bark-boring beetle - Ips subelongatus Motsch.

5. Histiogaster ocellatus Vitzthum.

Vitzthum, 1926, Zool. Jahrb. Syst., LII, 177, figs. 35 to 36 (Tyroglyphopsis).

Hypopus. This hypopus is unknown to me. Judging from Vitzthum's description and diagrams, it is allied to H. fillipovi and differs only in the following characters:- it is smaller, faintly yellow in colour and the idiosoma is slightly wider. The setae of the dorsal surface are slightly longer and, in spite of their thinness, easier to detect than is usual in the hypopus. The postanal setae are about 10% of the idiosoma in length. Vitzthum has described the "eyes" as follows: "under the first protrusion or notocephale (= propodosomal shield), on each side, is an oval, dark, chestnut-brown, light-sensitive organ. The anterior third of each protrudes freely, whilst the remaining two-thirds is concealed by the notocephale. I can only attribute the function of eyes to these extraordinary organs, although I cannot detect a genuine colourless cornea above the retina; they thus differ considerably in structure from similar organs in the preceding species". From Vitzthum's drawing, fig. 35, one can see that they are obliquely placed, almost touching anteriorly and diverging posteriorly. The gnathosoma is more slender, 3.5 times longer than its width, with parallel sides, which diverge slightly behind; the ends of epimeres II approach one another and are not bent externally; the long ventral suture is slightly marked; the coxal sucker is very small; a membranous border surrounds the sucking disc, but is not conspicuous; the peripheral suckers are smaller than in the preceding species, the anterior ones being smaller

than the others. The apical seta of genu I is not shown in the diagram and nowhere is it mentioned in the text, possibly on account of its small size (had it been of the same size as that of fillipovi, it would undoubtedly have been noticed by Vitzthum). The ventro-lateral setae of tibiae I and II are represented by spines of moderate length; similar but much shorter spines represent the external lateral setae of genua I and II. Tarsus I is somewhat shorter and more massive; sensilla delta is placed, judging from the diagram, at the same level as the sensory rod; the apical and preapical setae (3 of each) of tarsi I and II are distally placed and have inconspicuous lanceolate widenings. The ventral setae of tibia and genu III and tibia and femur IV resemble spines; the setae of tarsi III and IV are longer than in fillipovi and three of them terminate in small leaf-like widenings, like those of the anterior tarsi; the longest of the setae on tarsi III and IV and one of the dorsal ones are not more than twice the length of the tarsus and are broadened at the end. Length 175μ, width 142μ.

Habitat. A single specimen was found on a bark-boring beetle - Xyleborus pfeili Ratz. at Brout-Vernet, France.

13. Genus Schwiebia Ouds.

Oudemans, 1916, Entomol. Ber. IV, 264.

Type species: Schwiebia talpa Ouds, 1916.

V e, sc i, the pseudostigmatic organ, h i, d_1, d_2, and in most cases d_3 and l a, are absent, also one of the pairs of posterior setae (sa e). Epimeres III and IV approach each other and even sometimes join at their internal ends. The legs are short and massive, powerfully armed; the ventral setae of the tibia, the basal and external setae of the genu, the internal and middle setae and eta of tarsi I and II are represented by strong, conical spines; delta arises near the

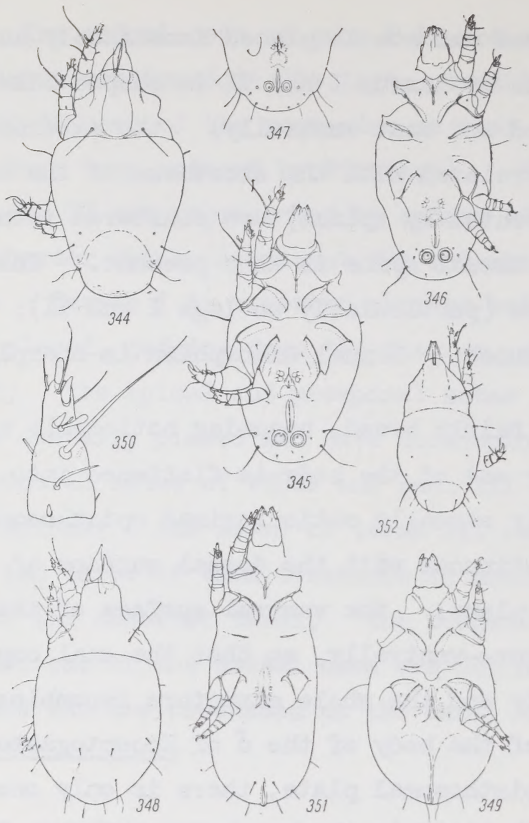
base of the sensory rod and eta is placed immediately anterior to it; the middle apical seta of tarsus I and II is shaped like an elongated plate, which is arched and bent ventrally; the external ventral seta is capilliform; correlated with the shortness of the tarsi, the 5 ventral setae (represented by spines) are clustered round the apex of the joint; 1 large dorsal spine is also present. The claws are very large and massive (particularly on legs I and II); the praetarsus is completely reduced. Sexual dimorphism is sharply defined.

♂. The idiosoma is fairly broad, becoming noticeably narrow posteriorly; the posterior end of the body is flattened into a semicircular, horizontal, moderately strongly cuticularised opisthosomal plate, whose dorsal surface is continuous with the dorsal surface of the hysterosoma and lies in the same plane; the ventral surface of this plate is indented and slopes antero-ventrally, so that the anal copulatory suckers face postero-ventrally and the whole structure resembles a similar modification of the end of the body of the ♂ of Eccoptogaster; on the dorsal surface of the opisthosomal plate, there is only one pair of setae (d_4) in most cases displaced to the very edges of the plate (only in S. vitzthumi are d_4 central in position). P_1 and p_2 are represented by minute microsetae. In most species, only the heteromorphic males are known, but in S. tshernyshevi, the homeomorphic males are found in small numbers.

♀. The idiosoma is usually narrower and larger than in the ♂, and cylindrical; the opisthosomal plate is absent and the posterior end of the body unmodified; only one pair of anal setae is present.

The larva has large mushroom-shaped "brustst iele". The hypopus has only been found in one species, therefore it is difficult to give the general characters of this stage.

Six palearctic species can be included in the genus Schwiebia, one oriental (S. italica Ouds. 1923 from Java) and 2 or 3 non-arctic (Monieziella xylophaga Banks 1912, M. ulmi Jacot 1936, and probably M. brevipes



Figs. 344 - 352

Fig. 344 - Schwiebia tshernyshevi, sp.n., heteromorphic ♂, dorsal surface. Fig. 345 - Ditto, ventral surface. Fig. 346 - S. tshernyshevi, sp.n., homeomorphic ♂, ventral surface. Fig. 347 - S. rossica, sp.n., posterior end of body, ♂, ventral surface. Fig. 348 - S. pachyderma, sp.n., ♀, dorsal surface. Fig. 349 - Ditto, ventral surface. Fig. 350 - S. pachyderma, sp.n., leg I, dorsal surface. Fig. 351 - S. rossica sp.n., ♀, ventral surface. Fig. 352 - S. ipidis Vtz., heteromorphic ♂, dorsal surface (after Vitzthum).

Banks 1906). Most species are found in woods, living under the bark of tree stumps and in leaf mould, S. xylophaga lives in the decomposing stems of lucerne.

Schwiebia Ouds.*

Males

1(2) Apex of genu with 2 setae; ventral spines of tibia and genu III fine, poorly developed (in the heteromorphic form); tarsi I and II very short, p_3 arising near the posterior edge of the opisthosomal plate, at the same level at the postanal microsetae (p_2) (Subgenus Megninietta Jacot).

6. S. (M) rossica sp.n.

2(1) Apex of genu I with only 1 very long seta; the heteromorphic form has very large spines on tibia and genu III, with rounded ends; tarsi I and II longer; p_3 arising from the lateral edges of the ventral surface of the opisthosomal plate, much anterior to the level of the posterior pair of anal microsetae (p_2).

Subgenus Schwiebia s.str.

3(4) D_4 arising from the central part of the opisthosomal plate; d_3 and l a represented by microsetae; sa e 3 times shorter than p_3 and more than twice as short as l p. Germany.

2. S. (s.str.) ipidis Vitz.

4(3) D_4 arising from the sheer edge of the opisthosomal plate; d_3 and l a absent, sa e slightly longer than p_3 and more than twice as long as l p. U.S.S.R. (Odessa region).

1. S. (s.str.) tshernyshevi, sp.n.

Females

1(2) Epimeres III united internally with epimeres IV; apex of

genu I with 2 dorsal setae; ventral external seta of tibia I and II absent; idiosoma much elongated, from 2.2 to 2.4 times longer than wide; lateral edges of hysterosoma straight, parallel over the greater part of their length. Length 280 to 360μ. (Subgenus Megninietta Jacot).

6. S. (M) rossica sp.n.

2(1) Epimeres III and IV free, not united; apex of genu I with only 1 dorsal seta, both ventral setae of tibiae I and II well developed; idiosoma less elongated, from 1.65 to twice as long as wide; lateral edges of the hysterosoma more or less convex. (Subgenus Schwiebia s.str.)

3(4) Length of the idiosoma 1.66 to 1.7 times its width; posterior end of the body narrowly rounded, skin thick, feebly coloured, brownish; propodosomal shield indistinct; setae of the hysterosoma very fine, flexible, capilliform; legs III and IV scarcely shorter and thinner than the 2 anterior pairs; sensory club of tarsi I and II straight, slightly widening towards its end. Length 295 to 370μ. U.S.S.R. (Moscow, Kalinin region).

5. S. (s.str.) pachyderma sp.n.

4(3) The maximum length of the idiosoma is a little less than twice its width; posterior end of body widely rounded; skin of normal membranous consistency, colourless, setae of the idiosoma stronger and straighter; legs III and IV much shorter and finer than legs I and II; sensory club of tarsi I and II strongly curved, with an expanded club-shaped end.

5(8) L a and d_s represented by distinct microsetae.

6(7) Length 590 to 630μ; propodosomal shield distinct; setae of the idiosoma longer. Germany.

2. S. (s.str.) ipidis Vitz.

7(6) Length 365 to 465μ; propodosomal shield indistinct; setae of idiosoma shorter. Yugoslavia.

3. S. (s.str.) cavernicola Vitz.

8(5) L a and d_3 absent. U.S.S.R. (Odessa region).

1. S. (s.str.) tshernyshevi sp.n.

*NOTE: The ♂ of S. pachyderma has not been included in the key, as it is unknown; the ♀ of S. talpa has been insufficiently described.

1. Subgenus Schwiebia s.str.

The apex of genu I has 1 dorsal seta. The body of the ♀ is moderately elongated, the length of the idiosoma 1.65 to twice its width; the distance between the bases of legs II and III is not great; epimeres III and IV are free, not connected at their ends.

1. Schwiebia (s.str.) tshernyshevi sp.n. (Figs. 329, 342 to 346.)

♂. Heteromorphic stage. The hysterosoma is greatly widened in the scapular level, behind this level it gradually becomes narrower towards the posterior end, as far as the depressions which mark the base of the opisthosomal plate; no sudden narrowing occurs behind the bases of legs III; the idiosoma is 1.7 times longer than the widest part of the hysterosoma. D_3 and 1 a are completely absent and d_4 are displaced to the extreme edge of the body; p_3 arise from the lateral edges of the opisthosomal plate, almost in linear series with sa e and considerably anterior to a transverse line drawn through the base of the posterior pair of postanal microsetae (p_2); sa e are only slightly shorter than p_3 and twice as long as 1 p; p_1 are closer to the anal suckers than to sa e. The ventral spine of the tarsus and the external lateral spines of tibia and genu III are very massive and terminate distally in a widely rounded apex. Length

210 to 365μ, width 123 to 215μ.

♂. Homeomorphic phase. The idiosoma is noticeably narrower than in the heteromorphic ♂. The legs are shorter and more massive. The epimeres and trochanters III are only slightly less developed than in the heteromorphic phase. Length of the only specimen 330μ, width 165μ.

♀. The idiosoma is more than twice as long as its greatest width; the lateral edges of the hysterosoma, from the scapular region to the origin of 1 p, are very slightly convex, almost straight; the posterior end of the body is widely rounded. The cuticle is of normal consistency, soft, thin and membranous; the coxal fields I and II are slightly denser and more heavily cuticularised; the propodosomal shield is distinct and well-defined; sc e are about 25% of the idiosoma in length; the setae of the hysterosoma are of medium length, stiff and fairly thick; d_3 and 1 a are absent. Legs III and IV are considerably smaller in size than legs I and II; for a considerable distance, epimeres IV are almost parallel to the longitudinal axis of the body; their ends are clearly separated from those of epimeres III. Trochanters I and II are very powerful; the apical seta of genu I is strong, half the length of the apical seta of tibia I; the sensory club is strongly curved and expanded towards its end. The genital slit lies between epimeres IV. Length 360 to 465μ, width 180 to 240μ.

Hypopus. This resembles that of the genus Robinisca and, to a still greater extent, the hypopus of Caloglyphus tshernyshevi. The idiosoma is egg-shaped, 1.5 times longer than its width; the dorsal surface is moderately convex and smooth, all the setae arising from it are very short. The propodosomal shield is 4 to 4.2 times shorter than the hysterosomal, with a rounded, feebly marked rostrum; the eyes and pseudostigmatic organ are absent. The gnathosoma, which noticeably protrudes beyond the anterior edge of the propodosoma, is twice as long as wide at its base, distally it is split for some quarter of its length and the branches of the fork are not separate. The sternal shield is evenly

cuticularised, with an absolutely straight posterior edge and straight lateral sides which converge posteriorly; the sternum only continues beyond the centre of the shield; epimeres II are practically straight, converging posteriorly at an angle of 45° and approaching at their ends. The anterior edge of the ventral shield is straight, as well as the lateral edges which are short and form almost a right angle with the anterior; the posterior edge is sinuous. The genital shield is completely separate, its anterior edge, as usual, repeating the curve of the posterior edge of the ventral shield, from which it is separated by soft cuticle. The suckers of coxal fields I are reduced, the suckers on coxal fields II well-developed. The sucker plate is of the usual structure, near the posterior edge of the body; all the peripheral suckers are of the same size, the secondary ones feebly developed.

Legs I and II are long, fairly slender; they can be almost completely seen when the animal is viewed from above; the ventral setae of the trochanter and femur are short; the ventro-lateral setae of tibia and genu are represented by fairly large, but slender lanceolate setae; the setae of genu I comprise an apical seta and a very short proximal one; the sucking seta is leaf-shaped terminally. The middle ventral seta is shaped like a spine and both lateral setae and all apical ones are thin and capilliform. There are no macrosetae on tarsi III and IV. Length 205 to 230μ, width 145 to 155μ.

This is described from 2 specimens, which were found enclosed within the protonymphal skin; by this means their relationship to the adult form was proved.

Distribution. It has only been recorded from a forestry plantation at Nerubaevsk (Odessa region).

Ecology. It lives in oak woods, underneath the bark of stumps.

2. Schwiebia (s.str.) ipidis Vitz. (Figs. 317, 318, 352.)

talpa Vitzthum, 1923 (non Oudemans 1916), Arch. Naturg. LXXXIX, 2, 151,

figs 50 to 55. - ipidis Vitzthum, 1932, Zool. Jahrb. Syst., LXIII, 697.

This is closely allied to the preceding one, but differs from it in details of chaetotaxy and in being larger.

♂. Heteromorphic phase. The greatest width of the body is not at the level of the shoulders, as in S. tshernyshevi, but more posterior and near the middle of the length of the hysterosoma; the general shape of the body is thus different from that of the heteromorphic ♂ of S. tshernyshevi; d_3 and 1 a are represented by very small microsetae; d_4 arise from the central part of the opisthosomal shield, at a considerable distance from its lateral edges; sa e are one-third the length of p_3 and less than half that of 1 p. On either side of the anal slit are 2 pairs of small rounded structures, which, in shape and size, resemble anal pores. In all other characters it is similar to the heteromorphic males of S. tshernyshevi. Length 383 to 600μ, width 260 to 267μ.

♂. Homeomorphic phase. Unknown.

♀. This differs from that of S. tshernyshevi in its largersize and in the presence of d_3 and 1 a, which are microsetae. Length 590 to 600μ, width 235 to 260μ at the level of the shoulders.

Hypopus and other immature stages are unknown.

Habitat. It has only been recorded from Germany.

Ecology. It lives in the breeding galleries of Ips laricis and Hylastes palliatus Gyll.

3. Schwiebia (s.str.) cavernicola Vitz.

Vitzthum, 1932, Zool. Jahrb. Syst. LXII, 697.

Only the ♀ is known. It is closely allied to S. ipidis and differs only in its smaller size - length 365 to 465μ - and in the shorter idio-

somal setae and tarsus. The gnathosoma is also more displaced posteriorly and the propodosomal shield is indistinct.

Habitat. It was found in caves in Jugoslavia, where water had collected.

4. Schwiebia (s.str.) talpa Ouds.

Oudemans, 1916, Entomol. Ber. IV, 265.

This has been described from 1 ♀ found in the neighbourhood of Bonn in rotting leaves. The original description of Oudemans is as follows - "Schwiebia gen.n. belongs to the Tyroglyphinae, it resembles Tyroglyphus, but has a dorsal shield as in Suidasia Ouds, and Hericia Can. It differs from both genera in having short fat legs and only 2 setae on the dorsal half of the propodosoma. Trochanters I have also a strongly cuticularised dorsal surface. S. talpa is a miniature edition of a mole and is 333μ long, on each tarsus there are 3 or 4 short spines; the short legs with digging claws indicate a burrowing mode of life, similar to that of Acarus (Sarcoptes)".

The above diagnosis was used by Vitzthum, as he was in possession of Oudemans' drawing and was therefore able to compare his own description of S. ipidis with it. According to this description, the true talpa is identical in all details with S. ipidis; it differs only in the propodosomal shield extending posteriorly further than the level of the scapular region, and in that all the longer setae of the hysterosoma, although bent, are stronger; however, all these characters do not provide a clear picture of S. talpa and give little indication of its relationship to the species described here. The small size of Oudemans' species (♀ = 333μ) and its habitat (rotting leaves) lead me to think that it may be identical with the form described here as S. pachyderma, but against this is the absence in S. pachyderma of a clearly marked propodosomal shield and the possession of thickened cuticle on the dorsal surface of trochanters I; also, the setae are finer. That S. talpa is not identical with Vitzthum's species, has been noted by Oudemans; the possibility that it

is idential with S. tshernyshevi seems slight, considering the difference in habitat. Therefore the position of S. talpa remains uncertain.

5. Schwiebia (s.str.) pachyderma sp.n. (Figs. 348 to 350.)

♀. In its general form and proportions, the body is similar to a small Rhizoglyphus. The idiosoma is relatively wide, its maximum length is 1.6 to 1.7 times its width; the lateral edges of the hysterosoma behind the shoulders are slightly drawn together, and then become moderately arched up to the point where l p arise; the posterior end of the body is slightly pointed. The cuticle is very dense, thicker than in other species of Schwiebia and indeed, than in all known species of Tyroglyphoidea; it is faintly coloured a dirty brown and there is no well-defined propodosomal shield. Sc e are longer and thicker than all the other setae of the idiosoma; in length they are 20 to 22%. All the setae of the hysterosoma are very thin and flexible, the longest are h e, which are 12 to 15% of the idiosoma; l a and d_3 are much displaced posteriorly and short, i.e. 3 to 4.5%, but even so, they are longer than in S. ipidis; i_4 are slightly longer than l p and s a, which are about 9% of the idiosoma in length; p a are almost equal to h e. Characteristically, legs III and IV are relatively long, only slightly shorter than the anterior ones. Epimeres III are arched, almost transverse and touching at their ends; epimeres IV are almost straight and slope posteriorly; trochanters I and II are particularly strong; the apical dorsal sensillae of genua I and II are small, blunt setae; the sensory club is straight, gradually thickening towards its rounded end.

Tarsi III and IV are relatively slender, IV is noticeably longer than the tibia and genu taken together, 2.5 times longer than their diameter. The genital slit is placed completely between epimeres IV; the posterior edges of the genital folds diverge almost at a right angle; the genital "suckers" are small. Length 293 to 370µ, width 175 to 220µ.
♂ unknown.

Habitat. It has only been recorded from 2 districts in the U.S.S.R., near Moscow and in the Ukraine, from which material was obtained. It lives exclusively amongst dead oak leaves, but perhaps may also occur in other kinds of deciduous forests.

2. Subgenus Megninietta Jacot 1936

Jacot, 1936, Ann. Entomol. Soc. Amer. XXIX, 631.

The apex of genu I has 2 dorsal setae. The body of the ♀ is elongated and narrow; the length of the idiosoma is 2.3 to 2.4 times its width; the distance between the bases of legs II and III is very great; the ends of epimeres III merge with those of epimeres IV.

6. Schwiebia (Megninietta) rossica sp.n. (Figs. 199, 200, 347, 351.)

♂. Heteromorphic phase. The whole of the anterior half of the hysterosoma to the level of the posterior edges of trochanters III is of even width and has parallel sides; the lateral edges then suddenly converge, and, posterior to this point, the body narrows gradually as far as the base of the opisthosomal plate. D_3 and 1 a are completely absent, d_4 are displaced to the edge of the body; p_3 arise from the posterior edge of the opisthosomal plate, at the same level as p_2, and considerably nearer to the mid-line of the body than sa e, the latter are slightly longer than p_3; p_1 are much further from the anal copulatory suckers than from sa e, forming with them and p_2 a regular arched row. The ventral spine of the tarsus and the external lateral seta of the genu and tibia of legs II are thin and feebly developed. Length 235 to 210μ, width 100 to 170μ.

♂. Homeomorphic phase. Unknown.

♀. The idiosoma is greatly elongated, like that of Monieziella, the ratio of its length to breadth is 2.3 to 2.4:1; the lateral edges are

straight and almost parallel, the posterior end rounded. The cuticle is normal in consistency, soft, thin and colourless; coxal fields I and II are not heavily cuticularised; the propodosomal shield is distinct, clearly separated from the soft surrounding cuticle; it is divided by a longitudinal, soft, flat membranous strip of cuticle into 2 narrow independent shields. Sc e do not exceed 7 to 8% of the idiosoma in length; the setae of the hysterosoma are very short, thin, but fairly stiff; the length of h e is 6 to 7, l p, d_4 and sa e 4 to 5, p a about 6% of the length of the idiosoma; d_3 and l a are absent.

All the legs are very short and epimeres III are joined with the ends of epimeres IV; the sensory club is sharply bent into an arc and expanded distally; the diameters of the tibia, genu and femur of legs I and II are less than their lengths; the external ventral setae of tibia I and II are absent. The genital opening extends anteriorly to the level of the anterior edge of epimeres III, and the posterior ends of the genital folds diverge at an obtuse angle; the genital "suckers" are relatively small. Length 280 to 360μ, width 110 to 150μ.

Larva. Like the ♀ and nymphs, this has a strongly elongated idiosoma; the "brustst iele" are slender, approximately 9μ in length and 2.1μ in diameter in the widened part.

Hypopus. Not known.

Habitat. It was found near Moscow and in the Velikoluksk region of the Kalinin province. It lives in more or less large colonies beneath the bark of silver birch stumps.

14. Genus Monieziella Berl.

Berlese, 1897, 107.

Type species: Monieziella berlesiana nom.n.

This genus is closely allied to the preceding one; v i are absent,

as well as sc i, h i, d_1 to d_3; l a are long, equal to l p in length. In the ♀, both pairs of sa are developed (and are represented by relatively long setae) and 1 pair of adanal setae. The structure of the opisthosoma in the ♂ is similar to that of Schwiebia. Epimeres III and IV are parallel to each other along their entire length and end freely. The setae of the tarsi are not so prominent as in the preceding genus, but are similar to those found in the genus Thyreophagus; the dorsal apical spine is thin and the ventral ones are feebly developed; eta does not resemble a spine and is probably reduced; the external and internal ventral setae are thin; the claws are feebler than those of Schwiebia, whilst the praetarsus is larger, forming 1 or 2 vertical semicircular plates enveloping the base of the claw. The body in both sexes is much elongated, in the ♂ 2 to 2.6 times longer than its width and, in the ♀, 3 to 3.4 times longer. The heteromorphic phase of the ♂ is unknown. Nymphal stages have not been described.

Hypopus. This resembles that found in the genus Histiogaster, but it is more elongated and a pair of well-developed eyes is placed on the lateral edges of the propodosoma above the bases of leg I; each consists of a semi-spherical transparent lens, which is raised above the body surface and backed by a layer of pigment.

In the genus Monieziella, I am placing 2 European species which, up to now, have been confused with each other: M. corticalis Michael 1885 and M. berlesiana nom.nov. (= M. mali Berlese 1897 non Schiner 1868, M. corticalis auct.pt.). As I have not seen either of these species, I am obliged to describe them and give the generic characters from the descriptions and drawings made by Michael and Berlese.

Monieziella Berl.

Males

1(2) Gnathosoma excessively narrow, chelicerae becoming still

narrower towards the base, so as to form a fairly short 'neck'; h e long; idiosoma nearly 290 to 300μ. England.

1. M. corticalis Mich.

2(1) Gnathosoma of normal shape, chelicerae not narrowing towards the base, h e short; idiosoma nearly 360 to 365μ (M. mali Berl.) Italy.

2. M. berlesiana nom.n.

Females

1(2) Total length of body almost 750μ. Italy.

3. M. magna Berl.

2(1) Total length of body not more than 600μ.

3(4) Sternum much shortened; legs III and IV longer than half the width of the idiosoma. Total length of body 450μ. England.

1. M. corticalis Mich.

4(3) Sternum normally developed; legs III and IV shorter than half the width of the body; total length of body 500 to 600μ. Italy.

2. M. berlesiana nom.n.

1. Monieziella corticalis Mich. (Figs. 319 to 322, 358, 359.)

Michael, 1885, Journ. R. Micr. Soc. ser. II, vol. V, 27, t. III, figs.1 to 14; 1903, 66, t. XXVII (Histiogaster).

♂. Homeomorphic phase. The gnathosoma is very narrow, the chelicerae narrowing towards the base and giving the appearance of a small elongated head separated from the propodosoma by a short 'neck'. The propodosoma narrows considerably towards the anterior end. The edges of the hysterosoma are somewhat convex along their entire length. H e and l a are long,

sa e and p_3 are placed near the posterior edge of the opisthosomal plate; the length of the legs is approximately 23 (I), 20 (II), 17 (III), 15 (IV) % of the length of the idiosoma. The average total length of the body is 350μ, the idiosoma is 290 to 300μ long, 90 to 120μ wide.

♂. Heteromorphic phase. Unknown.

♀. The sternum is considerably shorter than usual, legs III and IV are less than half as long as the maximum width of the body; the legs are 17 (I, II, IV), 16 (III) % of the length of the idiosoma; the genital slit is placed between epimeres III. The total length of the body is 470μ, of the idiosoma 410μ, width = 120μ.

Hypopus. The eyes are very large; epimeres II are short and do not nearly reach the posterior edge of the sternal shield, they are free; the anterior pair of suckers are the same size as the central pair; both posterior pairs are represented by very small suckers placed in a transverse row. The macrosetae of legs III and IV are very long.

Distribution. It has only been recorded from Warwick and Dorset, England, where it was found living on the dead epidermal layers of the rush Phragmites communis Tr.

2. Monieziella berlesiana nom.n. (Figs. 323 to 325, 360, 361.)

mali Berlese, 1897, 107. - corticalis Berlese, 1890, LVII, No. 7 (Histiogaster). Non Histiogaster corticalis Mich. 1885, nec Acarus malus Schimer 1868.

This is allied to the preceding species, but the body is larger and it differs in the following characters:

♂. Homeomorphic phase. H are short; the gnathosoma is normal in shape and the chelicerae are not narrowed at the base. The length of the idiosoma is 360 to 365μ, width is 130μ.

♀. The sternum is normal, the legs shorter, in length they are 21 to 22 (I), 20 (II), 10 to 11 (III) and 12 (IV) % of the idiosoma, legs III and IV are 2.5 times shorter than the greatest width of the body. The genital slit protrudes slightly in front of the ends of epimeres IV; the length of the idiosoma is 400 to 525μ, its width about 190μ.

Hypopus. The eyes are smaller; epimeres II are very long and completely bent posteriorly as far as the posterior edge of the sternal shield, where they join with epimerites II. The anterior pair of suckers is smaller than the central pair and the same size as the 2 posterior pairs, which are placed in an arc-shaped line.

Distribution. Italy: it was found on Polyporus hirsutus. Included in this genus also is Monieziella magna Berl. which has been insufficiently described.

3. Monieziella magna Berl.

Berl. 1910, Redia VI, 386.

This resembles M. mali, but is slightly larger, the adult ♀ is up to 750μ long and 280μ wide, and was found in Palermo, Sicily.

15. Genus Thyreophagus Rond.

Rondani, 1874, Boll. Soc. Ent. Ital. VI, 67.

Type species: Acarus entomophagus Lab. 1852.

The gnathosoma is more massive than in other genera of the tribe Rhizoglyphini. The idiosoma is narrow, elongated and cylindrical. V e sc i, h i, d_1 to d_3 and l a, sa e and 1 pair of sacrals are absent; all the existing setae are thin, flexible, capilliform macrosetae - 18 to 50% of the idiosoma in length. The legs are short, fairly massive, the two posterior pairs well separated from the anterior. The chaetotaxy

of the legs is feebly developed, the setae thin and hair-like; gamma and delta are absent; eta, thin and rod-shaped, is external and anterior to the sensory rod; the external, apical seta of tarsi I and II is thin and long and there are 2 ventral, fine setae; the middle apical seta of tarsus I differs in structure in the 2 sexes; 2 ventral apical setae are present (the median one is ill-developed), which resemble the dorsal seta in their feeble development. The claws are of average size, the praetarsus large and well-developed covering the greater half of the claw (as in Tyroglyphini). Sexual dimorphism is strikingly apparent.

♂. Only the homeomorphic phase is found. The posterior end of the idiosoma forms a semicircular, horizontal opisthosomal plate, which is fairly strongly cuticularised and on the same plane as the ventral surface of the hysterosoma; the dorsal surface of the latter slopes sharply to form a steep incline where it joins the opisthosomal plate; all this inclined surface is densely cuticularised and dirty brown in colour; on the dorsal surface of the plate, only 1 pair of setae - d_4 - is found; sa e are displaced ventrally; p_1 and p_2 are minute microsetae, whilst p_3 are long and hair-like; the middle apical seta of tarsus I resembles a short, blunt-ended plate, which points ventrally.

♀. The posterior end of the body is unmodified, the opisthosomal plate absent; there are 2 pairs of anal setae (1 adanal and 1 postanal); the middle apical seta is bent upwards.

The larva has under-developed, button-shaped "bruststiele". Development is direct, and no hypopus is formed. The species is monotypical.

1. Thyreophagus entomophagus Lab. (Figs. 201 to 203, 330, 334 to 336.)

Laboulbène, 1852, Ann. Soc. Entomol. Fr., Bulletin, 54 (Acarus); Laboulbène et Robin, Ann. Soc. Entomol. Fr., (4), 317, t. X (Tyroglyphus);

Berlese, 1897, 107; 1898, XC, No. 1 (Monieziella); Michael, 1903, 55, t. XXVII (Histiogaster). - aleurophagus Sicher, 1894, in: Canestrini, Prospetto d. Acarofauna Ital., VI, 815 (Histiogaster).

Economic importance - cf. Newstead and Duvall, 1919: 91.

♂. The idiosoma is 2 to 2.3 times longer than its width, with regular, slightly convex lateral edges, which gradually become rounded towards the base of the opisthosomal plate. The approximate lengths of the setae of the dorsal surface of the idiosoma are - v i 15 to 16, sc e 35 to 40, h e 24 to 28, l p 18 to 20, sa i 23 to 26% of the length of the idiosoma; p_1 are external to the anal suckers and p_2 are immediately behind. The lengths of the legs are about 26 to 28 (I), 24 to 25 (II), 22 (III), 20 (IV) % of the length of the idiosoma; tarsi IV are much shorter than usual, shorter than the tibia. Length 270 to 450μ.

♀. The lateral edges of the idiosoma are less convex and more parallel with one another than in the ♂, they slope sharply at the posterior end of the body. The approximate lengths of the long setae are - v i 12 to 13, sc e 28 to 30, h e 20, d_3 10, l p 15, sa i 30 to 35, p a 20% of the length of the idiosoma. The lengths of the legs are 20 to 25 (I and II), 19 to 21 (III), 18 to 20 (IV) % of the length of the idiosoma; tarsi IV are noticeably longer than the tibia. Length 300 to 540μ.

Distribution. France, Italy, England, U.S.S.R. I have found it in Leningrad, Moscow, Ivanov and Barnaul.

Ecology. It lives in old flour and in various dry medicinal substances (ergot and Spanish fly) and on dry insect collections. It may damage flour if it has been stored for some time. It is only recorded as a synantropic species.

Species incertae sedis

1. Rhizoglyphus minor Dem.

Dementjev, 1913, Ztschr. Pflanzenkrankh. XI, 70, fig. 6.

This differs from R. caucasicus Dem. (= echinopus F. and R.) in being smaller; the legs and gnathosoma are a lighter orange-red in colour or else colourless; the body is narrow and elongated, with a cylindrical, anteriorly rounded, abdomen; the structure of the hypopus is also different. Four of the body setae are directed anteriorly and 2 postero-laterally; all the setae are fine and scarcely visible. The 2 setae on the epistome and the 2 scapular setae are similar to those of R. caucasicus. On the dorsal side of the third segment of legs I are 2 small setae of unequal length which diverge from one place, and join in such a way that it is difficult to see that there is not one, but two. In the body of the pregnant ♀, not more than one mature or half mature egg is visible. The wandering hypopus is white, and has only 2 setae on the gnathosoma. There are no setae on the dorsal shield and it does not project. The propodosomal shield is rounded anteriorly, and in other characters this species resembles R. echinopus.

The average length of the ♀ is 0.460μ, ♂ 0.340μ, according to Dermentjev, the hypopus measures 0.200μ.

Habitat. Caucasus, where it lives on vine roots with R. echinopus.

2. Rhizoglyphus trouessarti Berl.

Berlese, 1897, 110; Kramer, 1899, 143; Michael 1903, 144.

The legs of the heteromorphic ♂ have no spines, except for 2 very small ones at the end of the tarsi. It is very small (0.32μ long). The fourth pair of legs of the heteromorphic ♂ does not extend beyond the posterior edge of the abdomen and does not reach further back than the third pair of legs. Tarsi IV of the legs are not longer than the tibia; there are 3 pairs of short setae on the posterior edge

(according to Michael).

Habitat. It was found in France.

3. Rhizoglyphus eutarsus Berl.

Berlese, 1921, Redia XIV, 144 to 145.

The body of the heteromorphic ♂ is oval, fairly elongated, and rounded posteriorly; the body setae are rather longer than those of R. echinopus, the 2 dorso-lateral setae are longer than the others - almost equal to the width of the hysterosoma - and marginal in position. Of the scapular setae, the 2 external ones are longer. The legs are obviously longer than those of R. echinopus; the anterior tarsi are 4 times longer than their width in the middle, they are 90μ long and 15μ wide. The dorsal seta is absent from in front of the sensory rod; 2 thick, fairly long setae, their bases close to each other, arise from the middle of the ventral surface of the tarsus; the ventral seta, which is near the claw, is well-developed in echinopus and lacking in eutarsus. The base of the penis is short and conical, the distal part or stylet exceptionally long and sickle-shaped at at the end, the stylet is 80μ long, longer than the base. The anal suckers resemble those of echinopus.

The total length is 550μ, the width 320μ (according to Berlese).

Habitat. Palermo, Italy, in the soil.

4. Rhizoglyphus germanicus Berl.

Berlese, 1921, Redia XIV, 145.

The homeomorphic ♂ is oval and rounded posteriorly; 2 pairs of setae p_1 and p_2 arise in an arc, which is deeply convex posteriorly; p_1 and p_2 are short, equal in length and are placed close to the copulatory suckers; they barely reach the ends of these suckers. Two

ventral setae, between the suckers and edge of the body, are of the same short length; two postero-ventral setae - p_3 - which arise behind the transverse row, are short. Those arising from the edges of the body and the scapular region are considerably longer than in R. echinopus and equal to the width of the hysterosoma. The legs are thinner and longer than in echinopus; the setae of the anterior tarsi are less well-developed, but all the spines, especially the ventral ones and those on the tibia, are thinner and longer; the tarsi themselves are longer than in echinopus, more than 3 times longer than their own breadth. The base of the penis is a truncate cone, the stylet is not equal to the length of the base, but is sharp and lanceolate; the copulatory suckers resemble those of R. echinopus. The total length of the body reaches 520μ, the width 310μ (according to Berlese).

Habitat. Germany.

5. Rhizoglyphus globosus Berlese.

Berlese, 1921, Redia XIV, 145.

The homeomorphic ♂ is broadly oval, almost spherical and rounded posteriorly; from the body arise a large number of setae, of which 1 pair on the posterior edge almost equals the width of the hysterosoma; 3 lateral setae, which arise just posterior to the suckers, are shorter; 2 ventral setae, behind the above-mentioned, inserted in the corners of the posterior angles, are short. The legs are fairly short, but longer than those of R. echinopus; the anterior tarsi are approximately 3 times longer than their width, the setae arranged as in R. echinopus, but the dorsal spine, which lies above a long, sickle-shaped claw, almost equals the claw in length and is similar to it in appearance. The base of the penis is wide and conical, resembling a pestle in shape; the anterior half of the penis, when pulled from its base, equals it in length. The copulatory suckers have a specific structure,

with a large, internal, dark disc, which is radially striated. Total length is 380μ, width 280μ.

♀. This is more ovally elongated (it is almost twice as long as wide); projecting from the posterior lateral edge of the hysterosoma are 2 fairly long setae; similar ones arise from the lateral edges. Length 460μ, width 220μ (Berlese).

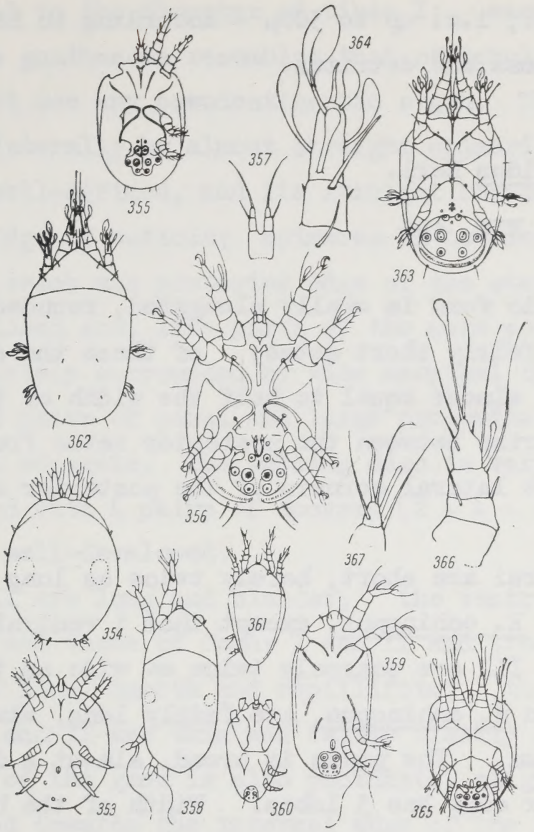
Habitat. Italy; it was found in decaying wood pulp and soil.

6. Rhizoglyphus occurrens Berl.

Berlese, 1921, Redia XIV, 146.

♂. The heteromorphic form is ovally elongated, with distinct shoulders and a rounded posterior end; arising from the posterior lateral angles of the body, fairly near to each other and almost equal in length to the breadth of the hysterosomal plate, are 2 fairly long setae. Ventrally, only five setae, barely visible under the high power, arise from the posterior edge; of these 1 seta is posterior to the suckers and another arises between the suckers and external edge. There are 2 dorsal marginal setae on each side, of which the posterior one is situated near the posterior angle. Copulatory suckers are fairly small and rounded, with a very small internal disc and well-cuticularised edges. The base of the penis is a broad truncate cone; the stylet is short, resembling a pestle, barely protruding from the base. The hind legs extend beyond the edge of the abdomen, whilst the middle ones reach it. The tarsi of legs I are short, barely twice as long as wide, the setae arranged as in R. echinopus. The 4 apical spines at the base of the claw are small, the posterior spines lie immediately posterior to them. Legs III are considerably thickened, with a fairly large dorsal spine behind the claw and 2 other spines at the base. Length 870μ, width 210μ.

♀. This is oval, angular at the posterior end, with 2 fairly long setae



Figs.353 - 367. Hypopi of different Tyroglyphidae

Fig.353 - Acotyledon michaeli Cuds., ventral surface (after Michael). Fig.354 - A. alberti A.Z., dorsal surface (after Michael). Fig.355 - Caloglyphus berlesei Mich., ventral surface (after Berlese). Fig. 356 - C. mycophagus Mégnin, ventral surface (after Mégnin). Fig.357 - C. mycophagus Mégnin, gnathosoma (after Mégnin). Fig.358 - Monieziella corticalis Mich., dorsal surface (after Michael). Fig.359 - Ditto, ventral surface (after Michael). Fig.360 - M. berlesiana nom.n., ventral surface (after Berlese). Fig.361 - Ditto, dorsal surface (after Berlese). Fig.362 - Rodionovia inopinata Vtz., dorsal surface (after Vitzthum). Fig.363 - Ditto, ventral surface (after Vitzthum). Fig.364 - R. inopinata Vtz., tibia and tarsus I, dorsal view (after Vitzthum). Fig.365 - Froriepia vimariensis Vtz., ventral surface (after Vitzthum). Fig.366 - F. vimariensis Vtz., leg I (after Vitzthum). Fig.367 - F. vimariensis Vtz., leg II (after Vitzthum).

at both sides. In length it is up to 390μ, width 260μ (more often, specimens are smaller, i.e. up to 300μ - according to Berlese). It lives in Italy, in moss and detritus.

7. Rhizoglyphus algidus Berl.

Berlese, 1921, Redia XIV, 146

♂. The heteromorphic form is ovally elongated, rounded posteriorly, and ornamented with fairly short setae; of these the scapulars and 2 posterior ones are almost equal to half the width of the abdomen; 2 very small setae arise between the posterior setae from the hind edge of the abdomen; the lateral corners of the posterior edge also bear 2 short setae each.

The anterior tarsi are short, barely twice as long as wide, the setae arranged as in R. echinopus, except that 1 ventral spine is placed subapically. Tarsi III are scarcely twice as wide as tarsi IV, the setae, arranged as in R. echinopus, are fairly long, almost reaching to the end of the abdomen. The penis is broad, almost a disc, without stylets, its anterior edge has 3 lobes. Width of the body is 220μ, total length 380μ.

It differs from R. trouessarti in being larger in size and in its more elongated shape, the posterior edge is straighter and from it arise a larger number of longer setae. The chaetotaxy of the tarsi is different, also the structure of the penis (according to Berlese).

Habitat. Italy, in mountain moss, 2,500 metres altitude.

16. Genus Lackerbaëria gen.n.

Type species: Lackerbaëria cribratissima sp.n.

Hypopus. The idiosoma is oval, with a moderately concave dorsal surface; this is strongly sclerotised and densely or coarsely covered with

pits; the setae projecting from it are relatively longer and, on an average, are equal to the diameter of tibia I; each seta is thin and capilliform. The gnathosoma resembles that of Schulzea. No eyes are present. I cannot see any pseudostigmatic organ. The sternal shield is well-defined laterally by almost straight epimerites II; posteriorly it is less well-defined, and its straight boundary is outlined by an unthickened ridge of cuticle; epimeres II are free and feebly arched, they by no means reach the posterior edge of the sternal shield; coxal fields III are closed and, like parts of the more posterior ventral shield, are completely surrounded by wide marginal thickenings; within these there are 2 pairs of coxal and large pregenital suckers; the genital shield is not separate. The sucking disc is very large, characteristic in shape and with 4 pairs of suckers (2 + 4 + 2); the auxiliary suckers are very well-developed.

Legs I and II are long and slender; the ventral setae of trochanters I are short and those of femur I and II and trochanters II respectively are fairly long, smooth and capilliform; the ventro-lateral setae of genua I and II are thin and fairly clearly pectinate; the dorso-basal seta of the genu is also pectinate, slightly curved, and strongly displaced towards the internal edge of the segment, resembling the corresponding setae found in nymphs and adults of the Glycyphagidae (e.g. Gohieria); the apex of genu I has 1 dorsal seta; on tarsi I the "sucking" seta is thin and terminates in a small "saucer"; the apical and preapical setae are long and feebly lanceolate; legs IV are very short; tarsi III have 1, tarsi IV 2 very long macrosetae. Only 1 species is known.

1. Lackerbatteria cribratissima sp.n. (Figs. 368, 369.)

Hypopus. Large in size and deep red-brown in colour. The dorsal surface is covered with round deep pits of different sizes (on a mounted specimen the shields give the appearance of being perforated), which sometimes merge with one another; instead of the usual transverse stri-

ation on the anterior edge of the hysterosomal shield, the surface is finely punctate. The propodosomal shield is triangular, with feebly protruding antero-lateral edges, it is rather more than 2.3 times shorter than the hysterosomal. The gnathosoma does not protrude beyond the apex of the rostrum, its arists are long and diverging. The pregenital suckers are very wide apart; the sucking disc resembles in shape and structure that found in certain Glycyphagidae (e.g. the genera Horstia and Neohorstia); in its posterior part are 3 well-thickened regions: 1 between the posterior suckers and 2 external to them; the central suckers are not larger than the peripheral; the posterior ones are placed excentrically in a thick, strongly cuticularised frame. The sensory rod of tarsi I and II is slender, with a characteristically bent and pointed end; on tarsi I and II are 4 lanceolate setae; on tarsi III and IV there are 3 of them; the macrosetae of tarsi IV are very long. Length 255 to 300μ, width 170 to 210μ.

Distribution. It has only been found in the suburbs of Ivanov. Hypopi were found in large numbers on a wasp, Crabro fossorius L.

17. Genus Robinisca gen.n.

Type species: Tyroglyphus mycolichus Ouds. 1912.

Hypopus. In its characters, it resembles hypopi found in the genus Caloglyphus. The idiosoma is a regular ellipsoid shape, with a smooth (very finely punctate) strongly convex dorsal surface. All the setae of the dorsal surface are very thin microsetae, which are not arranged in any characteristic way. The propodosomal shield is widely rounded at the anterior end and lacks a rostrum; v i are very small. No eyes are present. The pseudostigmatic organ is large and thick, bent into an S-shape. The gnathosoma is very long and thin (not less than 3 times as long as its greatest width); it is not segmented, but protrudes con-

siderably beyond the widely rounded anterior edge of the idiosoma; the arists are slightly arched and approach each other at their ends. The sternal shield is clearly outlined, with elongated lateral edges; the sternum does not nearly reach the posterior edge of the sternal shield; epimeres II vary in length and are sometimes free, at other times they reach the posterior edge of the sternal shield, thus closing coxal fields II; coxal fields III are closed and almost touch along the mid-line of the body; epimeres IV unite with each other and with the vertical ventral suture well beyond the anterior edge of the ventral shield; the genital shield is more or less clearly defined; the surface of the shields of the ventral side of the body are evenly cuticularised and the thickened edges are not particularly developed. The coxal suckers are well-developed; the sucking disc is large, situated near the posterior end of the body and bearing 4 pairs of suckers (the additional suckers at the angles of the plate are well-formed).

Legs I and II are medium in length; the whole of leg I and the greater part of leg II protrude beyond the edge of the idiosoma; the ventro-lateral setae of the tibia and of genuaI and II are flattened, lanceolate spines; or else only the ventro-lateral setae of the tibia have this structure, on the genu they are capilliform setae. The dorsal seta of the same genu is very short and thick, the apex of the genu only bears 1 seta. Tarsi I are slender; sensilla beta is a rod, arising at the same level as the main sensory rod, or it is slightly more proximal in position; sensilla gamma is absent and delta is also shaped like a rod; the "sucking" seta has a very larger "saucer"; one of the ventral setae is spine-shaped, the remaining ventral seta and all the apical setae are slightly widened; tarsus IV has thick short setae and spines and no macrosetae.

In the genus Robinisca I can include, in addition to R. mycolicha Ouds. and R. macrocnemis sp.n. which are described here, only the Brazilian species - Tyroglyphus fuscipes Ouds. 1924. This is closely allied to R. macrocnemis, differing in its considerably larger size - 358 to

380μ - in its gnathosoma being completely hidden by the anterior edge of the idiosoma and by the slightly different shape of the latter; the structure of legs I and II and their chaetotaxy, the structure of sternal and propodosomal shields in R. fuscipes is similar to that of R. macrocnemis.

Robinisca gen.n.

Hypopi

1(2) Tibia I enlarged, almost twice as long as genu I and more than 1.5 times longer than its diameter; visible part of the propodosomal shield very narrow - about 10 times shorter than the hysterosomal; epimeres II not nearly reaching the posterior edge of the sternal shield; externo-lateral seta of genua I and II capilliform; sensory club of tarsi I and II thin, cylindrical. U.S.S.R. (Ivanov region).

1. R. macrocnemis sp.n.

2(1) Tibia I of normal dimensions, shorter than genu I and of a normal diameter; visible part of propodosomal shield only 5.3 to 5 times shorter than the hysterosomal; epimeres II reaching the posterior edge of the sternal shield; externo-lateral setae of genua I and II spiniform, sensory club of tarsi I and II thick and enlarged. Holland, U.S.S.R. (Novotcherkassk region).

2. R. mycolicha Ouds.

1. Robinisca macrocnemis sp.n. (Figs. 177 to 179.)

Hypopus. A fairly dark, dirty brown in colour. The idiosoma is widely elliptical, strongly rounded and covered with very short setae. The propodosomal shield is very short, its visible part is less than one-tenth of the hysterosomal in length; sc are arranged in an almost regular transverse row. The gnathosoma is 3 times as long as its maximum width, with

slightly protruding lateral edges; it is not divided distally. Epimeres II by no means reach the posterior edge of the sternal shield, and epimeres IV do not reach the ventral suture which stretches as far as the posterior edge of the sternal shield; the ventral and genital shields and the parasternal sclerites have large pores; the longitudinal striations on the ventral folds of the hysterosomal shield are also more distinct than usual, and anterior to the scapular region they are replaced by a series of small raised knobs.

Tibia I is extraordinarily large, almost twice as long as genu I and more than 1.5 times longer than their own maximum diameter; tibia II is only slightly longer than the genu and only slightly longer than its diameter; tarsi I and II are very slender. The ventral setae are short on femur I, longer on femur II; the externo-lateral setae of genua I and II are thin flexible setae, and the ventro-dorsal seta of tarsi I is very long; the ventro-lateral spines of tibia I and II have serrated edges. Sensilla eta is very long (almost as long as the whole tarsus), it is slightly arched and gradually tapers toward its bulbous end; the ventral seta is large and serrated; the apical and preapical setae of tarsi I and II are more broadly lanceolate than in the succeeding species. On tarsus IV the dorsal seta is fairly long, and the apical dorsal seta is also lanceolate; the most proximal ventral seta is deeply serrated, the remainder are smooth, fairly thick, but they do not resemble spines. Length 293μ, width 242μ.

Distribution. It was found in 1 sample of earth well mixed with the residue left after the rye threshing, on a collective farm in Ivanovsk (in the village of Bolotovo).

2. Robinisca mycolicha Ouds. (Figs. 175, 176.)

Oudemans, 1912, Entomol. Ber., III, 250 (Tyroglyphus). - wasmanni Oudemans, 1913, Arch. Naturg., LXXIX, 10, 48, t. XVIII, figs. 17 to 18, (Tyroglyphus).

Hypopus. A pale light yellow in colour. The idiosoma is less broad than in R. macrocnemis, the relationship of its maximum length to width being 2.7:2; its dorsal surface is not so strongly rounded, and the setae are much longer. The visible part of the propodosomal shield is only 5 to 5.3 times shorter than the hysterosomal; sc are arranged in an anteriorly concave row. The gnathosoma is 4 times longer than its width, with absolutely straight parallel edges, it is bifid at its distal end. Epimeres II extend as far back as the posterior edge of the sternal shield and the sternum extends as far back as a line drawn through the bases of acetabula II, the sternum by no means reaches the posterior edge of the sternal shield; epimeres IV meet the longitudinal ventral suture, which extends only as far posteriorly as the middle of the ventral shield; the texture of all the ventral plates is the same, all are finely punctate. The pores of the ventral suckers on the sucking disc are separate from one another, each having an independent edge.

Legs I are 45% of the total length of the idiosoma; tibiae I and II are normal in size, shorter than the corresponding genua and their own diameter. The ventral setae of femora I and II are short; the externo-lateral setae of tarsi I and II are short thick spines; the apical seta of tarsi I is fairly short and the spines on tibia I and II are smooth; tarsi I and II are rather shorter and more massive than in the previous species; on tarsus I sensilla gamma is more proximal in position than the wide, club-shaped sensory rod; sensilla eta is fairly short, straight and cylindrical; the stalk of the "sucking" seta is very thick, with a mushroom-shaped end; the ventral seta resembles a spine, and the apical and preapical setae of tarsi I and II are very slightly lanceolate in shape. On tarsus IV the dorsal seta is short, the apical dorsal, and the greater number of ventral setae, are pointed like needles. Length 165 to 231μ, width 130 to 180μ.

Distribution. It has been recorded from Holland and the U.S.S.R. (near Novotcherkassk).

Ecology. Oudemans' material came from a mole's nest; the only specimens that I possess came from soil in a wheat field. R. tarsispina, which I have not found, evidently belongs to the same genus.

3? Robinisca tarsispina Ouds.

Oudemans, 1912, Entomol. Ber., III, 50 (Hypopus).

Hypopus. It is closely allied to Hypopus spinitarsus Herm. It differs from earlier known species in the following characters:-

1. The anterior edges of the pro- and mesosoma are almost parallel, the propodosoma thus resembling a wide band; it is not triangular in shape.
2. There are no vertical setae.
3. The gnathosoma (hypostome) is long and has only two apical elongated setae.
4. The legs are not only thinner, the setae and sensory rod are also thinner.

According to Oudemans, it was found in decomposing straw in Florence. Additional information is given by Vitzthum in his description of Tyroglyphus mayaorum (Arch. Nat. 86, 10, 54), when comparing this species with T. tarsispinus Ouds.; he says that in the latter epimeres I and II are also short and free, i.e. they do not anything like reach the posterior edge of the sternal shield, and there are no lateral setae on the opisthosoma. This is all that has been published concerning T. tarsispinus Ouds.

18. Genus Viedebanttia Ouds.

Oudemans, 1927, Entomol. Ber., VII, 485.

Type species: Viedebanttia schmitzi Ouds 1927.

It has been insufficiently described and is known only as the hypopus, which is allied to the genus Robinisca.

The diagnosis of the genus given by Oudemans amounts to the following: the gnathosoma and idiosoma have almost the same structure as in Zschachia necrophori Duj. 1849 (family Anoetidae); the idiosoma, like that of Tyroglyphus, is wider. Ventrally it also resembles Tyroglyphus, but the sucking disc is more posterior in position. The legs resemble those of Caloglyphus, but there are no lanceolate setae on legs I and II.

Only one species is included here.

1. Viedebanttia schmitzi Ouds.

Oudemans, 1927, Entomol. Ber., VII, 485.

It is light yellow in colour, whereas the deutonymphs of Caloglyphus are reddish-brown. The gnathosoma is 4 times longer than its width. The propodosoma is very short, barely longer than the basal diameter of legs I and II, thus appearing like a narrow, transverse strip. The dorsal setae are short, thin, and difficult to see; there are 2 distinct setae on the posterior edge. The trochanter and femur of legs I and II are almost the same length, whereas the tarsi are about equal to the combined lengths of the tibia and genu (according to Oudemans).

Distribution. It was found in a mole's nest in Holland.

19. Genus Troupeuia gen.n.

Type species: Tyroglyphus novus Ouds. 1907

Hypopus. The idiosoma is elliptical in shape, with a moderately regular convex dorsal surface, which may be smooth or punctate. All the setae of the idiosoma are short, thin microsetae, which are difficult to

see. The gnathosoma is longer than its width, non-segmented, with parallel lateral edges; its arists are straight, diverging almost at a right angle. No eyes are present. The pseudostigmatic organ is large, distinct and of the usual bristle shape. The sternal shield is well-outlined laterally, but is less distinct posteriorly; its lateral edges gradually become rounded and merge with the posterior edge, without forming a distinct angle with it; the sternum does not reach the middle of the shield; epimeres II are free, more or less strongly curved, their ends do not, by far, reach the posterior edge of the sternal shield; coxal fields III are closed along the middle line of the body over a considerable distance; the genital shield is long and not clearly separated from coxal fields IV; its surface, as well as that of the sternal shield, is regularly, but not strongly, sclerotised. Coxal suckers I, and sometimes II, are replaced by microsetae. The sucking disc is round, closely apposed to the posterior edge of the body; the auxiliary suckers are not clear.

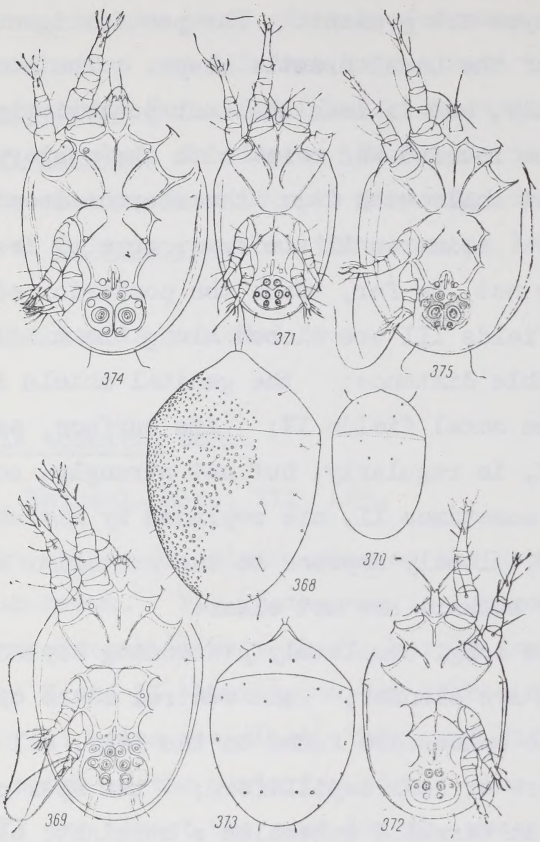
Legs I and II are long, completely protruding beyond the edges of the body. The tarsi are slender; the ventral setae of trochanter and femur I are long; no spines are found on the legs, all the setae being thin, flexible and more or less capilliform; the apex of genu I has only 1 seta; delta on tarsus I resembles a straight, blunt rod; the apical and preapical setae are long, capilliform (not widened into a leaf shape).

To this genus also probably belongs a tropical form - novisimilis Vtz. 1920 from Java, Ceylon, India and Brazil.

Troupeauia gen.n.

Hypopi

1(2) Sternal shield strongly produced posteriorly to form a trapezoid shape; epimeres II curved into an S-shape, diverging at their ends; dorsal shields soft; tarsi III and IV having 2 fairly long macro-



Figs.368 - 375. Hypopi of the genera Lackerbaüeria, Troupeauia and Schulzea

Fig.368 - Lackerbaüeria cribritissima, sp.n., idiosoma, dorsal surface. Fig.369 - L. cribritissima, sp.n., ventral surface. Fig.370 - Troupeauia nova Ouds., idiosoma, dorsal surface. Fig.371 - T. nova Ouds., ventral surface. Fig.372 - T. crabronis, sp.n., ventral surface. Fig.373 - Schulzea pamirensis, sp.n., idiosoma, dorsal surface. Fig.374 - S. pamirensis, sp.n., ventral surface. Fig.375 - S. caucasica, sp.n., ventral surface.

setae; externo-lateral seta of tibiae I and II absent. Germany, U.S.S.R. (near Moscow).

1. T. nova Ouds.

2(1) Sternal shield widely rounded posteriorly; epimeres III feebly curved, converging at their ends; dorsal shields covered with pits; tarsi III and IV without macrosetae; external ventro-lateral seta of tibiae I and II well-developed. U.S.S.R. (near Moscow).

2. T. crabronis sp.n.

1. Troupeauia nova Ouds. (Figs. 370, 371.)

Oudemans, 1907, Abh. Naturwiss. Ver. Bremen, XIX, 59, t. II, figs. 12 to 15 (Tyroglyphus)

Hypopus. This is pale in colour, slightly yellow. The idiosoma is somewhat more elongated than in the next species, the relationship of length:width in my specimen being 1.6 to 1.7:1; according to Oudemans' drawing, it is 1.5:1, probably the drawing was made from a slightly flattened specimen, as a still smaller width than that of my specimen (length 232μ, width 100μ) is mentioned in the text. The surface of the dorsal shields is smooth, the setae arising from them being short and difficult to see; v i are very short, sc are arranged like a trapezium. The propodosomal shield is large (equal to two-fifths of the length of the hysterosoma); anteriorly it is widely, but slightly abruptly rounded, and the rostrum is barely outlined. The gnathosoma has an entire distal end; the lateral setae are placed in the middle of its length and are very short. The sternal shield is much extended posteriorly, it is triangular in shape, with a rounded or almost truncate apex; its lateral edges (epimerites II) are feebly concave and are orientated at a sharp angle towards each other; the sternum is fairly long and epimeres II are S-shaped, with diverging ends. Both pairs of coxal suckers are replaced by very small microsetae (only visible under a $\frac{1}{12}$");

the pregenital suckers are less wide apart than in T. crabronis; the anterior genital suckers are further forward than usual. The sucking disc is not large; both pairs of peripheral suckers are of almost the same size; the auxiliary suckers are not differentiated. The external ventro-lateral seta of tibiae I and II is absent; the length of the sensory rod of tarsi I and II equals half the total length of the tarsus, it is considerably longer than sensilla eta, which is slightly thickened distally; sensilla delta is of the usual size, one-third the length of the sensory rod; tarsi III and IV have each 2 macrosetae, whose lengths do not exceed (they are usually shorter) the width of the idiosoma. Length 170 to 232μ, width 100 to 150μ.

Distribution. It has only been recorded from Germany (Bremen) and from some places near Moscow. The hypopi were found on Hylobius abietis and the wasp Crabro spinicollis H.S.

2. Troupeauia crabronis sp.n. (Fig. 372.)

Hypopus. In colour it resembles T. nova, but the idiosoma is wider. The surface of the dorsal shields is deeply pitted. The propodosomal shield is half the hysterosomal in length and has a well-defined rostrum. The gnathosoma has a bifurcate end. The sternal shield is not shaped like an elongated triangle, but is widely rounded posteriorly; its slightly convex lateral edges merge imperceptibly with the posterior edge, forming with it an uninterrupted regular arc; the sternum is short, epimeres II are slightly arched and approach each other at their ends. I was unable to see clearly whether coxal suckers III were each replaced by a seta. The sucking disc is larger than in the preceding species, the posterior suckers being larger than the lateral ones and the auxiliary suckers better developed. The external ventro-lateral seta of tibia I and II is well-developed. The sensory rod of tarsi I and II is one-third the length of the tarsus, the cylindrical sensilla eta equals it in length and is not thickened distally; sensilla delta is also very long, almost equal to the sensory rod and slightly thickened

at its end. There are no macrosetae on tarsi III and IV. Length 180μ, width 118μ.

Distribution. It has only been found in Mitishi (near Moscow), where one or two hypopi were found on several specimens of Crabro dives Lep. It is possible that the adults live on rotten wood.

3. Troupeauia ? mycobora Ouds.

Oudemans, 1912, Entomol. Ber., III, 188 (Tyroglyphus).

I have not found this myself. It is probably closely related to T. crabronis and might be considered identical with it, were it not for the emphasis laid on the unusually large size of the sensory rod on tarsi I and II; it is not so large in T. crabronis. The propodosomal shield is semicircular in shape. Only the hypopus has been described. Length 155μ, width 100μ, but the lateral edges of the body, including the sides of the proterosoma anterior and adjacent to legs II are reflected ventrally.

This species is closely related to T. mycophagus, but differs in the following characters:-

1. Legs I and II are thinner and more slender;
2. Tarsi I and II have fewer setae arising from the dorsal surface, and the sensory rod of each is extremely large; the proterosoma is semicircular, rather than triangular; the "fatty" glands are placed at a distance equal to their own length from the proterosoma; there are no suckers on coxae I, but only very small setae, whilst very small suckers are found on coxae III. The sucking disc is almost circular (almost square in T. mycophagus), and the suckers on it are arranged as follows: 2 of medium size, 2 large, and 4 small, which are arranged in an anteriorly concave arc.

It was evidently found among decaying leaves in Gaga (according to Oudemans).

20. Genus Rodionovia gen.n.

Type species: Tyroglyphus inopinatus Vtz. 1924.

Hypopus. The idiosoma is elongated, 1.7 times longer than its maximum width, which is at the level of the anterior angles of the hysterosomal shield; its dorsal surface is smooth and moderately rounded. All the setae of the dorsal surface are microsetae. The propodosomal shield is triangular; the lateral edges of the hysterosoma are almost straight, whilst its posterior edge is rounded. The gnathosoma is similar to that of Troupeauia. Eyes and pseudostigmatic organ are absent. The sternum is short. Coxal fields II are closed and well-defined, they almost merge into one another along the middle line of the body; the structure of the ventral shield resembles that of Troupeauia. The coxal suckers are normal in appearance and small. The sucking disc is very large and usually bears 4 pairs of suckers; auxiliary suckers are not developed. Legs I and II are fairly short, but protrude almost completely beyond the edges of the body; the chaetotaxy of the 4 basal segments is the same as in Troupeauia; the tarsi are moderate in length, each having 3 leaf-shaped setae; the "sucking" seta of tarsus I is long and thin, with a small oval "saucer" shaped like a Calla flower, that of tarsus II is flattened into a very large, leaf-shape; tarsi III and IV are short, and each has 4 leaf-shaped setae.

Only 1 species is included in this genus.

1. Rodionovia inopinata Vtz. (Figs. 362 to 364.)

Vitzthum, 1924, Arch. Naturg., XC, 10: 65, fig. 47 to 49 (Tyroglyphus).

Hypopus. Whitish in colour. The propodosomal shield has straight

antero-lateral edges, which converge anteriorly at a right angle. Sc are arranged in a trapezoid shape, sc i being much anterior to sc e; the length of the propodosomal shield is slightly less than half that of the hysterosomal. The gnathosoma is twice as long as wide, with parallel lateral edges and a slightly bifid apex, it is completely hidden beneath the rostrum (beyond the apex of which project the arists). The sucking disc is transversely oval and very wide (its diameter exceeds half the greatest width of the body); its suckers are therefore further apart than usual; the anterior ones are much smaller than the posterior and lateral ones, and much nearer to the genital suckers than to the central. The lengths of the legs are 36, 31, 17 and 17% of the length of the idiosoma; tarsi I are 2.5 times, tarsi II 1.5 times longer than the tibia. The setae arising from the basal segments of the legs are short. The sensory rod of tarsi I and II is large, its distal end forming a massive rounded club. Length 156μ, width 92μ.

Distribution. Germany, the hypopi were found on Cossonus linearis L., suggesting that R. inopinata lives on decaying wood.

21. Genus Garsaultia Ouds.

Oudemans, 1916, Entomol. Ber., IV, 265.

Type species: Garsaultia testudo Ouds. 1916.

This has been insufficiently described, only the hypopus is known. The diagnosis given for the genus is as follows: its chief characters are the same as those of the hypopus of Tyroglyphus s.lat. (i.e. the genus Tyroglyphus as it was understood prior to 1923-4), but the sucking disc has no free transverse edge and bears 10 suckers.

Only 1 species - G. testudo Ouds. - is known.

1. Garsaultia testudo Ouds.

Oudemans, 1916, Entomol. Ber., IV, 265.

Hypopus. This resembles that of T. macgillavryi; it has an elongated propodosoma which conceals the 2 pairs of anterior legs, it also possesses 10 suckers. However, it is not closely related to this species, because the anterior legs are massive and bear strong spines as in Tyroglyphus krameri. It differs from all other hypopi of the Tyroglyphidae in possessing a sucking disc devoid of a transparent and indistinct free edge; instead, its cuticularised edge merges directly with the surrounding tissue. Length 475μ, width 330μ, depth 186μ; in shape it is broadly oval and when seen in profile is more than semispherical in outline. The colour is brown and the dorsal setae are very small and thin. The dorsal surface is smooth. The genital shield is long and prolonged into the sucking disc. No genital suckers are visible. The ten suckers of the sucking disc are arranged as follows: 4, 4, 2; the 2 internal suckers of the anterior row are long and extensible; the 2 internal suckers of the middle row are very large, whilst the 2 posterior suckers are smaller than the others. Posterior to the sucking plate, there is an internal median chitinised rod (according to Oudemans).

Distribution. It was found near Bonn (Germany) in decaying leaves.

22. Sancassania Ouds.

Oudemans, 1916, Entomol. Ber., IV, 265.

Type species: Sancassania chelone Ouds. 1916.

As in the preceding genus, this is known only in the hypopial stage, which is insufficiently described. Oudemans' original diagnosis is as follows: In its chief characters it resembles the hypopus of Tyroglyphus, but it differs from it in having a bean-shaped soft area between the

propodosoma and hysterosoma, which is sharply outlined anteriorly and posteriorly. It is monotypical.

1. Sancassania chelone Ouds.

Oudemans, 1916, Entomol. Ber., IV, 266.

Hypopus. As in Tyroglyphus macgillavryi, the propodosoma is elongated and roofs over the 4 anterior legs. It is not closely related to this species, as the anterior legs are massive and protrude from beneath the shield; only 8 suckers are present; between the propodosoma and hysterosoma there is a wide sickle-shaped region of transversely striated soft cuticle. The dorsal setae are very short; the "fatty" glands are well forward in position; the anterior of the 4 internal genital suckers are conical in shape. The dimensions are not mentioned in the description (according to Oudemans).

Distribution. It was found near Bonn (Germany) in decaying leaves.

In my opinion this is closely related or is identical with Calogly-phus polyphyllae. Its most characteristic feature is the sharply defined sickle-shaped area of transversely striated cuticle on the hysterosoma, this is also conspicuous in C. polyphyllae, but in this case it is not soft, but is of the same dense consistency as the rest of the hysterosomal shield. Did Oudemans think this area was soft because it was striated? Usually in Cheyletidae, Trombidiidae and many Acaridiae a striated cuticle has a soft consistency. The conical shape of the genital suckers which characterises S. chelone is usually quite distinct in C. polyphyllae; all the other characters mentioned in the diagnosis of S. chelone, such as the shape of the propodosomal shield, structure of the legs, etc., correspond with those of C. polyphyllae.

23. Genus Schulzea gen.n.

Type species: Schulzea pamirensis sp.n.

Hypopus. The idiosoma is widely oval, with a moderately rounded dorsal surface; the dorsal shields are smooth and finely punctate; all the setae arising from them are short, fine and arranged in the normal pattern. The gnathosoma has well-separated distal segments. No eyes are present. The pseudostigmatic organ is well-developed. Coxal fields II are more or less clearly closed and wide apart; epimeres II (the lateral edges of the sternal shield) are strongly oblique; the sternum by far does not reach the level of the posterior edges of coxal fields II; coxal fields III are closed, but have a feebly marked internal outline, they are almost as wide apart as coxal fields II; the genital shield is not distinct; the surface of all the coxal fields is feebly sclerotised and thickenings of the edges of the ventral shield and coxal fields I are well-developed. The coxal suckers are well-developed and normal in structure; the sucking disc is large and bears 4 pairs of suckers; the lateral pair of suckers is external and anterior to the ventral ones; the auxiliary suckers are fairly distinct.

The ventral setae of the trochanter and femur I and II are very long and capilliform; the ventro-lateral setae of the genu and tibia and the dorsal basal setae of genua I and II are shaped like small, stiff (but not spine-like) smooth setae; the apex of genua I and II has long thick setae (as in the adults of Rhizoglyphinae and others). The "sucking" seta terminates in a small "saucer"; tarsus IV has a fairly long macroseta.

To this genus belong 2 species which are known only in the hypopial stage; they were collected from the solitary bees - Megachile and Prosopis. The accidental discovery of these hypopi on their hosts (both species were found on a bee) makes it possible to presume that the genus Schulzea is not closely associated biologically with these bees or their nests.

Schulzea gen.n.

Hypopi

1(2) Legs stout; tarsus I shorter than the genu and tibia I taken together; gnathosoma short and strong, completely hidden beneath the rostrum; its basal segment is almost square; macrosetae of tarsi IV shorter than half the width of the idiosoma. A larger species. Pamir.

1. S. pamirensis sp.n.

2(1) Legs slenderer; tarsus I considerably longer than the tibia and genu I taken together; gnathosoma long, its distal joints (fork) protrude completely beyond the rostrum; the basal joint is more than 1.5 times its width, gradually narrowing towards its apex; macroseta of tarsi IV equal to the width of the idiosoma. A smaller species. U.S.S.R., Georgia (Kartveli).

2. S. caucasica sp.n.

1. Schulzea pamirensis sp.n. (Figs. 373 to 374.)

Hypopus. This is an intense yellow brown in colour. The dorsal surface is moderately arched, densely cuticularised and thickly pitted; in addition, it is covered thickly with close, shallow depressions. The propodosomal shield is half the length of the hysterosomal. The gnathosoma is short, completely hidden beneath a concave rostrum, which is shaped like a camerostome on its ventral surface; its basal segment is almost square. Coxal fields II are not clearly closed, because their outline over a considerable distance is indicated only by a thin, non-sclerotised, fold of cuticle, and the ends of epimeres II themselves by no means join the internally-directed bent ends of epimerites II; the internal contours of coxal fields III and IV are feebly marked, and the edge thickenings of the coxal fields are relatively narrow. The coxal suckers are large; the sternal suckers are placed internal to the

narrow edge thickenings of coxal fields I on the more feebly sclerotised part of these fields; the ventral suckers are, however, completely surrounded by the thickened outlines of coxal fields III. The sucking disc is larger and nearer to the posterior edge of the body than in the succeeding species.

The legs are shorter and more massive, tarsus I being shorter than the tibia and genu I taken together. The sensory rod of tarsi I and II is fairly thick (8 or 9 times longer than its diameter at the base); sensilla delta of tarsus I is on the same level as the sensory rod and it is therefore more proximal in position than sensilla eta; the ventral pair and 1 of the apical (internal) setae of tarsi I and II are lanceolate. On tarsi III and IV, 4 of the setae are flattened and very long, only slightly shorter in length than the whole of leg IV. Length 325 to 345μ, width 240 to 250μ.

Distribution. This species was described from material collected in Pamir, without any further information concerning the locality. The hypopi were found in large numbers on the thorax of a bee - Megachile grombzevskii F. Mor.

2. Schulzea caucasica sp.n. (Fig. 375.)

Hypopus. Tinged with yellow. The relationship of the length of the idiosoma to its width is 1.35:1; on a mounted preparation, the outline of the idiosoma is more angular than in S. pamirensis, this is probably due to the deformation of the more dorsal surface, which is more convex and feebly sclerotised in S. caucasica; the idiosoma is completely smooth and finely punctate. The propodosomal shield is a quarter the length of the hysterosomal; the setae of the hysterosoma are very short, the postanal not longer than genu I. The whole of the gnathosoma, including its bifurcate end, protrudes beyond the rostrum, its basal segment is more than 1.5 times longer than its width at the base, and it becomes narrower towards the apex.

Coxal fields II are sharply outlined; the internal outlines of coxal fields III are barely discernible, and those of coxal fields IV are also indistinct; the thickened edges of the coxal fields are wide, particularly those on coxal fields I, where they fill almost the whole of the external angle between trochanters I and II. The coxal suckers are somewhat smaller than in S. pamirensis; the sternal suckers are placed on the angular thickenings of coxal fields I, the ventral ones in a similar position on coxal fields III; a relatively wide space separates the sucking disc from the posterior edge of the body, but it is somewhat smaller than in the previous species; the anterior pair of peripheral suckers is slightly larger than the posterior.

The legs are longer and more slender than in S. pamirensis, tarsi I being much longer than the combined length of the tibia and genu together. The sensory rod of tarsi I and II is very thin (20 times longer than its diameter at the base). Sensilla delta of tarsus I is considerably anterior to the base of the sensory rod, practically on the same level as sensilla eta; the apical and preapical setae of tarsi I and II are capilliform, like those of tarsi III and IV; the dorsal seta of tarsus IV is twice as long as the whole of leg IV. Length of a single specimen is 303μ, width 223μ.

Distribution. It has only been recorded from Georgia (Kartveli). It was found on Prosopis sp.

24. Genus Froriepia Vtz.

Vitzthum, 1919, Zool. Anz. L., 189.

Type species: Froriepia vimariensis Vtz. 1919.

Hypopus. This is easily distinguished from all other hypopi of the family Tyroglyphidae by the very long bristle-like claws on legs I, and the peculiar structure of the coxal-sternal skeleton. The idiosoma is oval in shape and anteriorly truncate; the dorsal surface is very finely

grained, but it is not possible to detect any setae arising from it; if they exist, they must be very short and thin. The gnathosoma is not segmented and is longer than its width. No eyes are present. The coxal-sternal skeleton is abnormal in structure: epimeres II, which merge with one another at almost a right angle, are fused with an elongated sternum; the ventrum and epimeres III meet at the same point, and the sternum is prolonged without interruption almost as far as the genital slit; thus a 6-rayed figure is formed and from the prolonged sternum the closed coxal fields I, III and IV radiate on either side; epimeres IV also join this longitudinal suture; epimerites II are absent, so that coxal fields II and the sternal shield are not outlined (and not separated from the field surrounding them). The coxal suckers are small and normal in structure; the genital suckers are very large and the sucking disc bears the usual 4 pairs of suckers (2 + 4 + 2).

The legs are short and thick, without any large spines. The tarsi are very short, all their covering setae very long, especially on legs I and II; the claws of leg I are almost the same length as the whole of the leg, and resemble the setae of the tarsi; on legs II they are slightly shorter and more sharply bent; on legs III and IV they are still shorter, but even so, are of extraordinary length and almost bristle-like. The sensory rod of tarsi I and II is long and expanded distally. The sensilla eta of tarsus I is almost the same length as the apical seta of tibia I; the "sucking" setae of tarsi I and II are very long; there are no macrosetae on tarsi III and IV. Only 1 species is known.

1. Froriepia vimariensis Vtz. (Figs. 365 to 367.)

Vitzthum, 1919, Zool. Anz. L., 190, figs. 1 to 4.

Hypopus. This is whitish in colour. The idiosoma is 1.5 times longer than its maximum width, which occurs at the level of coxal suckers III. The propodosomal shield is shaped like a narrow strip encircling anteriorly the hysterosomal shield, (its length along the mid-line is about 5μ,

i.e. about one-thirtieth of the hysterosomal shield); the rostrum is feebly marked and projects anteriorly in the shape of an arc. The gnathosoma is 11μ long and completely hidden beneath the anterior edge of the idiosoma; its end is slightly bifurcate and the arists are very long (40μ). The suckers on the sucking disc are almost all the same size (the central ones are only slightly larger than the peripheral). The anterior ones are very extensible, like those of Forcellinia.

The tarsus and part of the tibia of legs I and II protrude beyond the anterior edge of the idiosoma; tarsi I are bottle-shaped, with a very long (40μ) setiform and feebly bent claw and an extremely long (49μ) "sucking" seta, which has a bulbous end; in addition, on tarsus I there are 2 very long capilliform setae and 2 shorter ones that are almost like spines; the sensory rod, whose end almost reaches the apex of the tarsus, is peculiarly sharpened. Tarsi II are much shortened, with claws 24μ long and bent into an S-shape; the "sucking" seta is also very long (36μ) and broadened like a leaf terminally; the sensory rod protrudes far beyond the apex of the tarsus. Legs III and IV are also much shortened, their claws 20μ long; 1 of the apical setae of tarsi III is laminate terminally, the remaining setae resemble hairs and it is possible that on tarsi IV there is another seta which is also leaf-like, but this cannot be established with certainty. Length 145μ, width 98μ.

Distribution. It has only been recorded from Weimar (Germany), where a single hypopus was found on the wing of a ♂ ant - Lasius fuliginosum Latr.

II. Family Saproglyphidae

Saproglyphidae Ouds. 1924 + Winterschmidtiidae Ouds. 1924 + Ensliniellidae Vtz. 1925 + Czenspinskiidae Ouds. 1927 + Pontoppidaniidae Ouds. 1925 + Nanacaridae Ouds. 1923.

Characters of the family. Its representatives are, broadly speaking, very similar to those of the Tyroglyphidae. The idiosoma is always clearly divided into a propodosoma and hysterosoma, and the division of the latter into a metapodosoma and opisthosoma has never been observed. The cuticle is soft and thin, of a membranous consistency (usually smooth and structureless), sometimes with fine, longitudinal striations; the propodosomal shield is either absent (Saproglyphus, Nanacarus) or well-developed (Ensliniella, Riemia, Winterschmidtia), when it is shaped like those of the Tyroglyphidae; in the genus Ensliniella, its lateral edges anterior to the middle are deeply incised and the posterior region is adorned with a network of sculpturing, which is absent in all other genera; no opisthosomal shield is developed and there are no cuticularised plates associated with the coxal-sternal skeleton; only in the ♀ of the genus Winterschmidtia is the cuticle cuticularised behind the epimeres. Grandjean's organs are feebly developed in most species. All the setae are fine, feebly developed and variable in length; v e are absent, v i resemble those of the Tyroglyphidea and occupy the same position; sc i are always present, equal to or less than half the length of sc e; in most cases, they are well behind a line drawn through the bases of sc e. The pseudostigmatic organ is simple, sometimes pectinate; three pairs of humeral setae (h i, h e, s h) are arranged as in the Tyroglyphidae; alternatively, they may be more lateral in position, so that h i are marginal, h e subventral, and s h ventral; the position of d_1 and d_2 is variable; the laterals - l a and l p - are arranged as in the Tyroglyphidae, but are not so constant in position; 2 pairs of sacral setae - sa i and sa e - are present (Ensliniella and Calvolia) or only 1 pair - sa e (Winterschmidtia, Saproglyphus), sa i being replaced by

d_4, which are terminal. The "fat" glands have no openings and the anal "pores" are absent. Genital "suckers" are well-developed in both sexes. The coxal-sternal skeleton is more feebly developed than in the Tyroglyphidae; epimeres I unite to form a V or Y-shape, whilst epimeres II to IV are thin, with poorly-developed apodemes; in Saproglyphus, epimeres II are S-shaped, with oval apodemes and in the ♂ epimeres III and IV are peculiarly bent and slightly divided at the end; in Ensliniella, epimeres IV are modified and end in a smooth curve; epimerites II are feebly developed and never form an independent sclerite outlining the junction between propodosoma and hysterosoma, as in the Tyroglyphidae.

The length and proportions of the legs are variable, their general structure is the same in both families and does not deviate from the typical; praetarsi are always well-developed and more or less clearly stalked (becoming narrower towards the base); the claws are very small, inserted at the distal end of the praetarsus, with the base embedded in it; they have no articulated sclerites and therefore are not connected with the apex of the tarsi themselves; in the genus Nanacarus, claws are always present in nymphs, but absent in adults. The chaetotaxy of the legs resembles that of the Tyroglyphidae, but is somewhat more feebly developed; all the setae of the legs are small and thin, never like spines; the apical seta of the tibia is often displaced from the distal edge of the segment; the internal ventral seta of tibia I is sometimes absent (in males of Saproglyphus, and evidently in Winterschmidtia). The chaetotaxy of legs I, which is the same in all species, consists of a sensory rod - alpha - with a fine sensilla - beta - at its base; a sensory rod - delta - is usually present, and 3 medial setae, of which 2 are ventral and 1 lateral (eta); an apical group is composed of 3 thin setae and 1 to 3 ventral spines at the end of the tarsus; in the genus Winterschmidtia, the spines are very large; in Calvolia and Ensliniella, they are so much reduced as to be unnoticeable.

Secondary sexual differences are not great; the 2 sexes may differ in appearance, as well as in the presence and absence of certain of their

characters; this is most clearly shown in Nanacarus.

♂. The anal and tarsal suckers are usually absent. The genital opening is placed between the bases of legs IV or posterior to them, the setae surrounding it are then also displaced; the copulatory apparatus is complicated in structure and consists of several independent parts; the anus is nearer to the posterior end of the body than to the genital opening (from which it is separated by a wide space); 2 pairs of anal microsetae are present, the anterior ones sometimes placed in front of the anal slit or, with the posterior ones, on either side of it, only 1 pair of postanal setae is present, usually of considerable length. The secondary sexual characters are often shown in the structure of the legs; e.g. in Saproglyphus tarsi I and II are slightly thickened and compressed laterally, so as to form a longitudinal ventral keel; the apical ventral setae are also atrophied; in Calvolia and Winterschmidtia, the middle apical spine of tarsus I is replaced by a transverse sucker; in Nanacarus legs III and IV are somewhat thickened and bent, and the tarsal apical spine is enlarged. In addition, epimeres IV of the ♂ usually differ in shape from those of the ♀, and are often joined together with a fine transverse line. No heteromorphic males are formed.

♀. The genital opening is between epimeres III and IV, between the bases of legs IV, or even posterior to them (Nanacarus); it is almost identical with that found in the Tyroglyphidae, but differs in having the internal edges of the valves more feebly cuticularised; the valves also diverge more gradually from their point of union, hardly forming an angle where they begin to diverge. Many genera have a well-developed epigynium. The anal slit is always displaced posteriorly, the ends of its valves often protruding beyond the hind edge of the hysterosoma; evidently, there is no separate bursa copulatrix. Altogether, one or two pairs of anal setae are present; when two occur, one is placed anterior to the anal slit, the other on either side of it; there is also one pair of postanal setae.

Nymphal stages are known in only a few species. In most cases they closely resemble the adult, and differ only in those characters which distinguish the adults of the whole superfamily; in the genus Nanacarus, however, an interesting deviation from this is observed and the nymphal praetarsi are each armed with a well-developed claw, which is absent in the adult.

The larvae have well-developed "brustst iele"; in some species, where sc i, d_1, h i, d_2 and l a are very short, these setae sometimes appear for the first time in the adult (according to Oudemans); in others, they are completely developed already in the larva (Saproglyphus). In no representative of this family can one observe an obvious displacement of setae during development, as is shown by the v e setae in the Tyrophagini and by many others in the Glycyphagidae.

Inactive hypopi are not formed by any species, so far as is known; the migratory hypopi are all of the entomophilic type, like those of the Tyroglyphidae, but in the Saproglyphidae the sucking disc is more feebly developed.

The gnathosoma is strongly reduced; in some genera it is completely fused with the idiosoma and is only represented by a pair of arists (Ensliniella, Vidia); In others (Calvolia), it is shaped like a rectangular plate, rigidly fused with the idiosoma at its base and apically divided into a pair of segments, each clearly spearate from the base and terminating in an arist. The idiosoma is usually rather elongated, it becomes narrower towards its rounded posterior end, which is less prominent than in the Tyroglyphidae; the posterior edges are feebly flattened or completely rounded, and never form a peripheral sucking ring. A line of demarcation separates the propodosomal shield from the hysterosomal, with which it is fused. The dorsal shields almost completely cover the whole dorsal surface of the idiosoma, but are not reflected on to the ventral side to form epipleura; only in the genus Calvolia are the anterior angles of the hysterosomal shield slightly reflected on to the ventral surface in the form of short, posteriorly-directed epipleura;

on the other hand, in the genera Ensliniella and Vidia the posterior dorsal shield leaves the edges of the hysterosoma uncovered, and these are formed of feebly striated cuticle; in most species, the surface of both shields is engraved by thin lines, which anastomose with each other, forming a reticulate pattern; the angular elongated depressions are placed transversely (in the middle of the propodosomal shield), diagonally (at the periphery) and longitudinally (on the hysterosoma). In some forms the lines are so close together as to form a longitudinal striation; other types of pattern (e.g. pits) are not found, but frequently the surface of the shield has no ornamentation and seems (at least, in preparations) completely smooth. The dorsal setae are very short and difficult to see; in Calvolia, the pseudostigmatic organ is well-developed and arises from a special depression, as in the Oribatei. The majority of species have a well-developed pair of eyes placed on the apex of the rostrum and always well-defined; each consists of a clear spherical lens, beneath which is a strongly pigmented cuticularised retina; in the subgenus Crabrovidia (of the genus Vidia), the eyes are feebly developed and represented by a pair of slightly raised transparent protrusions; these are placed above the rostrum and have no retina; in the subgenus Vidia s.str., eyes are completely absent. The sternal shield is moderately distinct, but feebly cuticularised like the rest of the ventral surface of the body; the structure of the sternum and epimeres II and epimerites II are the same as in the Tyroglyphidae; the ventral shield is well-developed and fused with the genital to form one structure. Coxal fields III are always closed by a median longitudinal suture; epimeres III are fused together to form an arc, which curves anteriorly and is joined medially by the fused epimeres IV; these have the usual Λ-shape. Coxal fields IV are not divided along the midline of the body, nor are they separated by a fairly distinct ventrum. The coxal and genital setae are more or less strongly reduced and never modified to form suckers. The sucking disc is small and has 4 pairs of suckers; the membranous edge of the disc is sometimes free, and may take the form of a radially striated border; the genital suckers have

a conical distal part, extended into a long thin spike.

Legs I and III have well-developed ambulacra, consisting of a stalked membranous praetarsus, often of great length, bearing a small claw on its end; tarsi III have no ambulacra, but large macrosetae. Legs I and III are of medium length, with long, slender tarsi; the arrangement of the setae on their proximal segments only differs from that of the Tyroglyphidae in having the dorsal seta of the tibia usually placed in the middle of the segment or even in its proximal half; the setae are never thickened to form spines. The chaetotaxy of the tarsi varies, it is usually composed of a fewer number of sensory organs than in the Tyroglyphidae; on tarsi I and II there are from 2 to 4 leaf-shaped setae; the "sucking" seta is absent; tarsi III also may have from 3 to 4 similar setae. Tarsus IV is sometimes fused with the tibia into a non-segmented tibio-tarsus, the tarsi have 1 or 2 macrosetae and 2 smaller setae and no ambulacra; in Ensliniella they are armed with peculiar, finger-shaped and scale-like spines. The length of the hypopi is uniformly from 175 to 270μ.

II. Family Saproglyphidae

Key to the genera

Adults

1(8) Sc i much shorter than sc e.

2(3) Praetarsus devoid of claw; apex of tarsus bearing ventrally a large spine, shaped like a claw; legs very short (18 to 22% of the length of the idiosoma); the 2 posterior pairs in the ♂ are appreciably thickened and curved; the genital opening is placed behind the base of legs IV, immediately in front of the anal opening. A small species not more than 220μ.

6. Nanacarus Ouds.

Only 1 species, N. minutus Ouds. Java, Germany, U.S.S.R. (Smolensk)

3(2) Praetarsi with distinct claws; apex of tarsus bearing ventrally 1 to 3 small spines (often indistinct); legs of medium length or else fairly long (not less than 30 to 35% of the length of the idiosoma); posterior legs of ♂ not thickened; genital opening in the ♀ placed between the bases of legs III and IV, and in the ♂ between legs IV. Larger species.

4(5) ♂ with large anal and tarsal suckers, the latter placed at the base of tarsus IV (one on each tarsus); sc i, h i, d_1, d_2 and 1 a are microsetae 10 to 12% of the idiosoma in length; sc e, h e, 1 p, d_3 and d_4 of medium length, capilliform (30 to 50% of the length of the idiosoma. A littoral species, living among Algae.

1. Pontoppidania Ouds.

Only 1 species, P. littoralis Halb. - Ireland.

5(4) ♂ devoid of anal and tarsal suckers, with 2 pairs of anal microsetae; lengths of setae different. Terrestrial species.

6(7) Three pairs of very long setae, d_4, 1 p and sa e, arise from the posterior end of the body (60 to 90% of the idiosoma in length), arising from conical warts; sc i 8 to 10 times shorter than sc e; epimeres II strongly curved, with very large apodemes; idiosoma narrow, strongly elongated; legs shorter and stronger; tarsi I and II in the ♂ without suckers.

2. Saproglyphus Berl.

Only 1 European species - S. neglectus Berl. Italy, U.S.S.R. (Kalinin and Odessa regions).

7(6) Only 1 pair of long setae, sa i, arise from the posterior part of the body (35 to 55% of the length of the idiosoma); sc i 2.5 to 6 times shorter than sc e; epimeres II feebly developed, almost straight, with narrow apodemes; idiosoma shorter and wider; legs long and thin, tarsi I and II in the ♂ with a large ventral sucker.

4. Calvolia Ouds.

8(1) Both pairs of sc of the same length.

9(10) Legs I and II strong, much longer than legs III and IV; tarsi very short and thick; their apical part bears ventrally 3 large recurved spines; sc noticeably longer than all the other setae of the hysterosoma; chelicerae normal in structure; genital opening of ♀ placed between the bases of legs IV, no epigynium.

3. Winterschmidtia Ouds.

Only 1 species, W. hamadryas Vtz. Germany.

10(9) All the legs are slender, I and II visibly shorter than III and IV; tarsi long, thin, without spines at the apex; sc somewhat shorter than the majority of the setae of the hysterosoma; chelicerae wide at the base and narrowing suddenly to a sharp point; genital opening of ♀ situated between the bases of legs III and IV, with a well-developed epigynium.

5. Ensliniella Vtz.

Hypopi

1(2) Legs IV very near the posterior end of the body, very strong, with very well-developed trochanters and tarsi provided with one strong digitiform spine and another shaped like a scale drawn out into a point, also 2 other strong setae and a very small one; hysterosoma with a longitudinal posterior apodeme; rostrum with a conspicuous pair of hemispherical eyes. On wasps of the genus Odynerus.

5. Ensliniella Vtz.

2(1) Legs IV placed at a considerable distance from the posterior edge of the body; trochanters small; tarsi without spines, bearing only simple setae; longitudinal apodeme absent. On various other insects.

3(4) A pair of very prominent eyes is placed on the apex of the

rostrum, which are provided with a distinct retina; gnathosoma well-developed.

4. Calvolia Ouds.

4(3) Eyes absent or feebly developed, with no retina and placed dorsally at the base of the rostrum; gnathosoma completely atrophied, only represented by a pair of arists.

7. Vidia Ouds.

1. Genus Pontoppidania Ouds.

Oudemans, 1925, Entomol. Ber., VI, 302.

Type species: Tyroglyphus littoralis Halbert 1920.

This is easily distinguished from all other genera of this family by the existence of tarsal and anal copulatory suckers in the ♂. Chelicerae normal in structure. The idiosoma is fairly wide in the ♀, almost pear-shaped and clumsy in appearance; the propodosomal shield is indistinct. Sc i are much shorter than sc e; h e, d_3, d_4, l p and sa e are of about the same length, 30 to 40% of the length of the idiosoma, whilst h i, d_1, d_2 and l a are shorter than sc i , 10 to 12% of the length of the idiosoma); the arrangement of the setae resembles more closely that found in the Tyroglyphidae than is the case for other genera of Saproglyphidae. The structure of the coxal-sternal skeleton is not atypical.

The legs are fairly long and slender; the ventral setae of the tibia are of moderate length, the tarsi are slender; on tarsi I and II delta and eta are capilliform, and have the same length and appearance as the ventral setae; the apical setae of the tarsi are short; the praetarsi and claws are fairly large.

♂. Tarsi I are unmodified; legs III and IV are not thickened; at the base of each tarsus IV is 1 copulatory sucker; the genital opening is posterior to the base of legs IV; the posterior pair of anal setae is

replaced by large round copulatory suckers; there are 3 pairs of short postanal setae.

♀. The structure of the genitalia is not described.

Only 1 species has been described - P. littoralis Halb. The immature stages are unknown.

1. Pontoppidania littoralis Halbert.

Oudemans, 1925, Entomol. Ber., VI, 302.

Type species: Tyroglyphus littoralis Halbert 1920.

♂. This is much smaller than the ♀, in length approximately 360μ, in width 200μ. The widest part of the body is across the anterior part of the hysterosoma; the posterior edge is clearly incised in the middle, a small protrusion arising directly above the incision. All the setae of the dorsal surface resemble those of the ♀, but their relative lengths are much longer. The "fat" glands are very large. The genital valves form a semicircular shield and there are 2 copulatory suckers, which closely resemble those found in Histiogaster entomophagus Lab. The legs are stout and have a structure which is characteristic for the genus; the tarsi of the last pair, however, instead of 2 small protruding suckers near the middle of the segment, have only 1 sucker, arising near the apex on the internal surface.

♀. Length 600 to 616μ, width 418μ. As a whole, the animal is pear-shaped, the surface cuticle smooth and translucent; the "fat" glands appear as large, brown patches. The cephalo-thorax is of a normal shape, noticeably narrower than the abdomen; it narrows anteriorly, so that the rostrum is fairly long and slender, similar to that of Calvolia heterocamus Michael. The setae of the cephalo-thorax are arranged in a transverse row, the external ones being very long, the internal ones short (about 66μ in length); the rostral setae extend slightly beyond the end

of the chelicera.

The abdomen has fairly conspicuous anterior angles; behind them the abdomen gradually narrows, then widens again towards the posterior edge, which has a sharp projection in its middle. This projection is not homologous with the tubular bursa copulatrix seen in the genus Glycyphagus. From the posterior edge project 5 pairs of long setae, of which 3 pairs are marginal; 4 pairs of relatively short setae are also placed near the margin. The epimeral fields and genital opening resemble those of Tyroglyphus siro. At the posterior edge of the ventral surface are 2 long setae and several pairs of short ones. The legs are normal, the fourth segment (tibia) bearing the usual long seta, and a strong bent spine (sensory rod) arises from the tarsus of both legs I and II (according to Halbert).

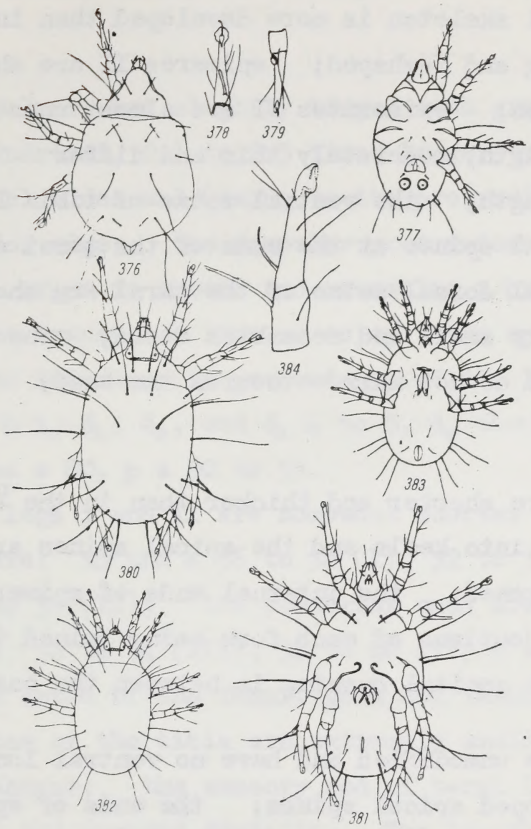
Distribution. It has only been recorded from Ireland, where 2 females and 1 male were found in moist decaying seaweed near Howth.

2. Genus Saproglyphus

Berlese, 1890, Acari, Miriapodi e Scorpioni Italiani, Padove, Firenze, LVII, No. 6.

Type species: Saproglyphus neglectus Berl. 1890.

The gnathosoma has a normal structure. The idiosoma is strongly elongated; the propodosomal shield is indistinct. Sc i are microsetae, 8 to 12 times shorter than sc e; h i, d_1 to d_3 and l a are also represented by microsetae; d_4, l p, sa e and p a are very long (50 to 90% of the length of the idiosoma), they spread out laterally to form the same fan-shaped train that is found in the Tyrophagini; all these long setae arise from conical warts, which give the posterior end of the body a very characteristic angular outline; all the dorsal pairs of setae are equidistant from each other, thus forming 2 almost parallel longitudinal rows; d_2 is somewhat nearer to d_1 than to d_3; d_4 are terminal (placed right at the edge of the idiosoma); l a is further from d_2 than d_3; whilst l p is almost on the same level as d_3 and,



Figs. 376 - 384

Fig.376 - Pontoppidania littoralis Halb., ♀, dorsal surface (after Halbert). Fig.377 - P. littoralis Halb., ♂, ventral surface (after Halbert). Fig.378 - P. littoralis Halb., tarsus I, dorsal surface, (according to Halbert). Fig.379 - P. littoralis Halb., tarsus IV, ♂, dorsal surface (according to Halbert). Fig.380 - Ensliniella parasitica Vtz., ♂, dorsal surface (according to Vitzthum). Fig.381 - Ditto, ventral surface (according to Vitzthum). Fig.382 - E. parasitica Vtz., ♀, dorsal surface (according to Vitzthum). Fig.383 - Ditto, ventral surface (according to Vitzthum). Fig.384 - E. parasitica Vtz., leg I, lateral view (according to Vitzthum).

like d_4 and sa e, arises from the edge of the body; sa e is equidistant from 1 p and d_4, whilst sa i is absent.

The coxal sternal skeleton is more developed than in other genera, the sternum being long and Y-shaped; epimeres II are sharply bent and have very wide apodemes; epimerites II are almost unnoticeable. The legs are medium in length, moderately thin and differ only slightly from each other in length; the ventral setae of tibia I and II are very small, the ventral spines at the ends of the tarsi are of medium thickness; the apical dorsal setae of the tarsi are short; delta is present and eta is very small and resembles a rod; the praetarsi are broad and massive, and do not narrow towards the base; the claws are relatively large.

♂. Tarsi I and II are shorter and thicker than in the ♀, their ventral surfaces are produced into keels and the apical spines are reduced; legs III and IV are unthickened; the internal ends of epimeres IV are forked, the posterior projections of each fork being joined together by a thin transverse line; the genital opening is between the bases of legs IV.

♀. Legs I and II are unmodified and have no ventral longitudinal keel; each has 3 well-developed apical spines; the ends of epimeres IV are not divided and the internal ends of epimeres III are connected together by a thin transverse line; the genital opening lies between the bases of legs III and IV and the epigynium is well-developed.

Only the larva, among the immature stages, is known; this closely resembles the adults, but the long setae of the hysterosoma are noticeably shorter; the "bruststiele" are long, slender and thickened distally like an orb.

To the genus Saproglyphus belongs 1 species - S. neglectus Berl. - and also 2 neopalearctic species - S. australis Ouds. 1924 and S.neotropicus Ouds. 1924.

1. Saproglyphus neglectus Berlese. (Figs. 41 to 44, 389 to 393.)

Berlese, 1890, Acari, Miriapodi e Scorpioni Italiani, Padove, Firenze, LVII, No. 6.

White in colour, but slightly tinged with green. The idiosoma is narrow and cylindrical, 2.1 to 2.5 times longer than its width, with straight parallel sides and (owing to its protruding conical warts) an angular posterior edge; the scapular protrusions are distinct. The pseudostigmatic organ is smooth and resembles a bristle. Sc i are almost on the same transverse line as sc e; the approximate lengths of the setae of the idiosoma (in percentages of its length) are v i 12, sc e 50, sc i, h i, d_1, d_2, and d_3 4 to 5, d_4 about 100, l a 6 to 7, l p 55 to 60, sa e 80, p a 50 to 55.

In the ♂, legs I and II are somewhat shorter than in the ♀, and their lengths are: in the ♀ 36 to 38 (I), 32 to 34 (II); in the ♂ 32 to 33 (I), 30 to 31 (II); the posterior ones are approximately the same in length: 32 to 34 (III), 38 to 40 (IV) % of the length of the idiosoma. The setae of the femur, genu and tarsus are medium in length; the ventral setae of the tibia are extremely small and, in the ♂, the external one is absent; the sensory rod of tarsi I and II is fairly thick, almost straight and rounded distally. The length of the ♂ is 220 to 305μ, its width 130μ; the ♀ is 250 to 310μ, its width 135μ. The larvae are relatively large (160 x 72μ).

Distribution. Italy (Vigodazere, near Padua), U.S.S.R. - Kalinin and Odessa regions (the Nerubaevski forestry commission). P.K. Chernishev and I have found S. neglectus under the dead bark of oak stumps; Berlese found a colony on decaying Polyporus hispidus.

3. Genus Winterschmidtia Ouds.

Oudemans, 1923, Entomol. Ber., VI, 206.

Type species: Suidasia (?) hamadryas Vtz. 1923.

The chelicerae are normal in structure. The idiosoma is elongated and cylindrical, the propodosomal shield distinct, smooth and with slightly concave sides. The two pairs of scapular setae are approximately equal in length, noticeably longer than all the other setae of the hysterosoma; these have all the same appearance and are fairly short, 20 to 25% of the length of the idiosoma; d_1 are placed very wide apart, near to h i; d_2, on the contrary, are near together (the distance between them is less than one quarter the distance between d_1); d_3 are almost equidistant from the lateral edges and mid-line of the body; d_4 are terminal; 1 a are well posterior to d_2 (nearer to d_3); 1 p and sa e are on the same transverse line and sa i are absent. The coxal-sternal skeleton is moderately well-defined, the sternum Y-shaped; the epimeres are slightly arched and have narrow apodemes, epimerites II are poorly developed.

Legs I and II are of medium length, very massive and adapted for digging; the posterior ones - III and IV - are considerably shorter and thinner. The ventral setae of the tibia are very fine, the external one evidently absent; the dorsal seta of tibia III and IV is much reduced. The tarsi are thick and short, distally they bear 3 large, sharply bent ventral spines (these are particularly prominent on the anterior legs); the median apical seta of the tarsi is very long; delta is absent, eta is a fine seta displaced to the ventral surface of the tarsus (which then bears 3 setae); the praetarsi are of medium size and fleshy; the claws are large.

♂. On tarsus I, the middle ventral spine is replaced by a large transparent sucker; legs III and IV are unthickened. The genital opening is placed between the bases of legs IV.

♀. The middle ventral spine of tarsus I is well-developed. The genital opening lies between the bases of legs IV; there is no epigynium; the anal slit extends as far as the posterior end of the idiosoma.

The hypopus, larva, and protonymph are unknown. The telonymph only

differs from the adult ♀ in having shorter setae on the idiosoma. Up to now, only 1 species has been described.

1. Winterschmidtia hamadryas Vtz. (Figs. 385 to 388.)

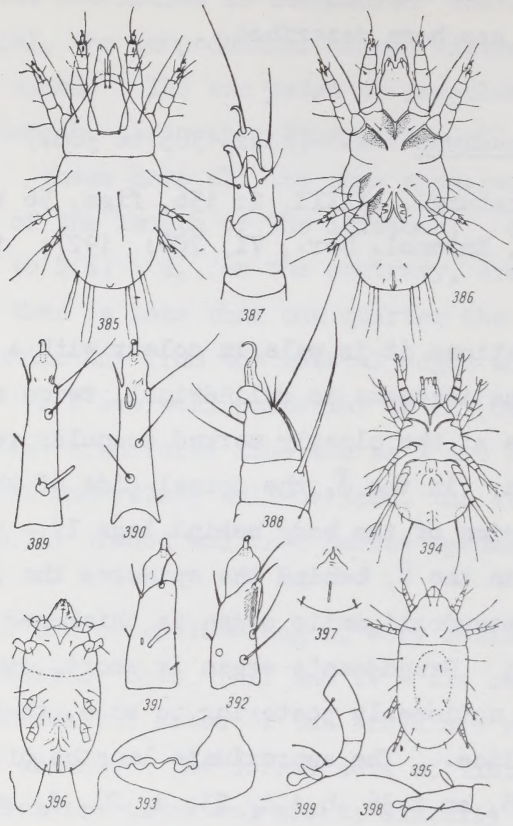
Vitzthum, 1923, Arch. naturg., LXXXIX, 2: 156, figs. 56 to 59 (Suidasia); Oudemans, 1923, Entomol. Ber., VI, 206; 1927; ibid., VII, 246 (Winterschmidtia).

On mounted preparations it is pale in colour with a noticeable yellow-ochre tinge. The idiosoma is cylindrical, twice as long as its greatest width, this is at the clearly marked scapular region. In the ♀, the cuticle issmooth; in the ♂, the dorsal side of the idiosoma - as well as the ventral region of the body behind legs IV - has fine longitudinal striations; in the ♀, behind the epimeres the cuticle is slightly sclerotised. The pseudostigmatic organ is thickened and its distal part clearly pectinate; Grandjean's organ is short, conical, and directed anteriorly; sc i are noticeably posterior to sc e, their bases joined by a thin, transverse line. The approximate lengths of the setae in the ♀ are: v i 12, sc e 38, sc i 36, h i, d_1 23, d_2 20, d_3 and d_4 23, l a and l p 21, sa e 17, p a 25% of the length of the idiosoma. The lengths of the legs in the ♀ are approximately 28 (I, II) and 16 (III, IV) %; the posterior legs do not extend anywhere near the posterior end of the body. The sensory rod of tarsi I and II is thin, cylindrical and slightly curved; of the 3 apical setae of I and II, one is very long and 2 are shorter than the ambulacrum. The length of the ♂ is unknown. The length of the ♀ is 300 to 350μ, its width is up to 170μ.

Distribution. Germany. It lives in the galleries of bark-boring beetles - Eccoptogaster rugulosus Ratz (in the bark of Prunus institia L.).

4. Genus Calvolia.

Oudemans, 1911, Entomol. Ber., III, 187. - Czenspinskia Oudemans, 1927, ibid., VII, 246.



Figs. 385 - 399

Fig. 385 - Winterschmidtia hamadryas Vtz., ♀, dorsal surface (according to Vitzthum). Fig. 386 - Ditto, ventral surface (according to Vitzthum). Fig. 387 - W. hamadryas Vtz., tibia and tarsus I, ♀, ventral view (according to Vitzthum). Fig. 388 - W. hamadryas Vtz., genu, tibia and tarsus I, ♀, lateral surface (according to Vitzthum). Fig. 389 - Saproglyphus neglectus Berl., tarsus I, ♀, dorsal view. Fig. 390 - Ditto, ventral surface. Fig. 391 - S. neglectus Berl., tarsus I, ♂, dorsal view. Fig. 392 - Ditto, ventral surface. Fig. 393 - S. neglectus Berl., chelicera, ♂, lateral view. Fig. 394 - Calvolia heterocoma Mich., ♂, ventral view (according to Michael). Fig. 395 - Nanacarus minutus Ouds., ♀, dorsal surface (according to Oudemans). Fig. 396 - Ditto, ventral surface (according to Oudemans). Fig. 397 - N. minutus Ouds., posterior end of idiosoma of ♂, ventral surface (according to Oudemans). Fig. 398 - N. minutus Ouds., tibia and tarsus I of ♀, lateral view (after Oudemans). Fig. 399 - N. minutus Ouds., leg IV, ♂, ventral view (after Oudemans).

Type species: Calvolia hagensis Ouds. 1911 (hypopus).

Chelicerae normal in structure, with a strongly protruding external surface. The idiosoma is medium in length and fairly narrow; in most species the propodosomal shield is indistinct. Sc i are 2.5 to 6 times shorter than sc e; h e are much longer than h i; all the other setae of the hysterosoma, with the exception of h e and the very long sa i, are short or medium in length, often somewhat stiff; p a are long and hair-like; d_1 are nearer to each other than to h i; d_2 are also close together, but d_3 and d_4 are further apart, d_4 often being remote from the posterior edge of the body; l p are nearer to d_4 than to d_3, whilst sa e are far removed from l p; sa i are terminal or slightly ventral.

The coxal-sternal skeleton is fairly weak, the sternum Y-shaped and the epimeres have very narrow apodemes; epimerites II and IV are distinct. The legs are fairly long and slender, with well-developed ventral setae on the tibia; the apical setae of the tarsi are relatively short; delta is shaped like a rod and eta is similar to both ventral setae; the praetarsi are fairly large, the claw small.

♂. Anal and tarsal suckers are absent. The genital opening lies between the bases of legs IV; the epimeres of the latter are joined by a thin sclerotised bar with a ring-shaped structure, which is the basis of the complicated genital apparatus. Tarsi I and II are much shorter and more massive than in the ♀; the apex of each bears ventrally a large transparent sucker, around which are arranged the ventral setae; these thus become displaced to the extreme end of the tarsus. Legs III and IV are unmodified, the apical chaetotaxy of the tarsi being similar to that of the ♀.

♀. The genital opening lies between the bases of legs III and IV; an epigynium is present. Epimeres III are free and normal in structure. Legs I and II are long and slender; eta and both ventral setae are median in position; the apical chaetotaxy consists of 1 median and 2

very short lateral setae.

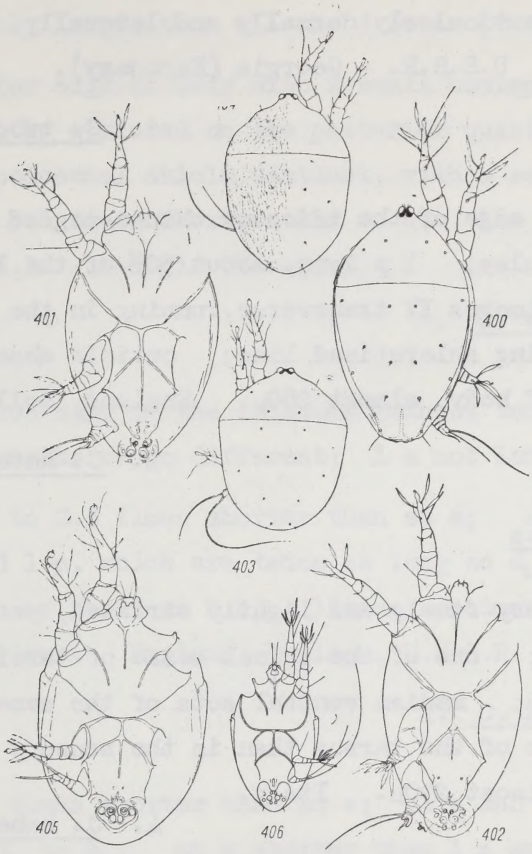
Hypopus. The apex of the rostrum bears a pair of semi-spherical, sharply protruding eyes, each with a crystalline transparent lens and well-formed dark retina. The gnathosoma is well-developed and consists of a massive basal part, rigidly fused with the idiosoma; this bears 2 fairly distinct distal segments, each terminating in a well-developed arist. The dorsal shields are variable in structure; the hysterosomal shield covers the whole of the dorsal surface and, anteriorly, is reflected on to the ventral side. Delta is always well-developed and is more proximal than the sensory rod; the arrangement of the distal setae of legs I and II varies. Legs IV are joined to the ventral surface of the body, at a considerable distance from the posterior and lateral edges of the hysterosoma, so that only the distal part of the tarsus protrudes beyond the lateral edges of the hysterosoma; trochanters III and IV are medium in size; the tarsi have no digitiform or other shaped spines. Other characters are very varied.

To the genus Calvolia belong 18 palearctic species, the majority of which (13) are only known as the hypopial stage; these are somewhat varied in structure, but not to such an extent as to affect the natural system of classification and necessitate further subdivision. I even did not find it possible to keep Czenspinskia Ouds. 1927 (type species: Tyroglyphus heterocomus Mich. 1903) in a separate genus, as the hypopi of this genus do not differ from those belonging to the genus Calvolia in any major characters (or in any associated character).

Calvolia Ouds.

Adults - Males

1(2) Posterior edge of the idiosoma right-angled at the sides and ornamented with 6 more or less semicircular tubercles; 1 p is 15 to 17% of the length of the idiosoma; epimeres IV diagnoal, form-



Figs.400 - 406. Hypopi of the genera Ensliniella and Calvolia

Fig.400 - Ensliniella kostylevi sp.n., dorsal surface. Fig.401 - Ditto, ventral surface. Fig.402 - E. parasitica Vtz., ventral surface. Fig.403 - Calvolia heterocoma Mich., dorsal surface. Fig.404 - C. elizabethae. sp. n., dorsal surface. Fig.405 - Ditto, ventral surface. Fig.406 - C. circumspectans Vtz., ventral surface (after Vitzthum).

ing an obtuse angle with the sclerotised line which joins them to the genital opening; skin striated on the posterior half of the hysterosoma, particularly dorsally and laterally. Total length of body 323μ. U.S.S.R. - Georgia (Karajazy).

1. C. tuberculata sp.n.

2(1) Posterior edge of the idiosoma obtuse-angled at the sides, without tubercules; 1 p long, about 50% of the length of the idiosoma; epimeres IV transverse, running in the same direction as the connecting sclerotised line; cuticle absolutely smooth. Total length of body, almost 280μ. England, Holland, U.S.S.R. (extreme east).

2. C. heterocoma Mich.

Adults - Females

1(2) Cuticle very finely and lightly striated, particularly on the ventral surface; one of the apical setae of tarsi I and II thickened like a rod; median ventral seta of the same tarsi situated nearer the base of the tarsus than is the sensory rod. Total length of the body, almost 290μ. Italy.

4. C. hebeclinii Sicher

2(1) Cuticle absolutely smooth or only lightly striated on the posterior part of the hysterosoma; all the apical setae of the tarsi setiform; median ventral seta of tarsi I and II more distal than the sensory rod. Total length of the body exceeds 300μ.

3(4) Dorsal setae fairly long (d_1 reaching 14 to 15, d_2 to d_4 20 to 25% of the length of the idiosoma), capilliform (very fine and flexible); 1 a and 1 p the same length as d_2 and d_3, and somewhat shorter than d_4; sc i 2 to 2.5 times shorter than sc e. A larger species; total length of the body 450 to 480μ. U.S.S.R. - Bachkiria (Sterlitamak).

5. C. karmenskii sp.n.

4(3) Dorsal setae very short (d_1 to d_3 not exceeding 7 to 12, d_4 9 to 14% of the length of the idiosoma), rather stiff; l a and l p noticeably longer than all the d setae (twice as long as d_1).

5(6) Posterior edge of body with 2 small hemispherical tubercles; cuticle lightly striated on the posterior quarter of the hysterosoma; propodosomal shield distinct, with a rounded posterior edge; sc i 3.3 to 3.6 times shorter than sc e; l a visibly longer than l p. U.S.S.R. - Georgia (Karajazy).

1. C. tuberculata sp.n.

6(5) Posterior edge of the idiosoma without tubercles; cuticle smooth; lengths of sc different; l a not longer than l p.

7(8) Sc i 2 to 2.5 times shorter than sc e; sa e noticeably longer than l a and l p, which are twice as long as d_1, d_2 and d_3; h i nearly twice as short as h e; living specimens yellowish or else orange in colour. England, Holland, U.S.S.R. (extreme east).

2. C. heterocoma Mich.

8(7) Sc I 5 times shorter than sc e; l a and l p are nearly twice as long as d_1 to d_3; sa e shorter than l a and l p; living specimens whitish in colour.

3. C. romanovae sp.n.

Hypopi

1(2) Tarsi IV ending in a strong macroseta. Germany.

8. C. kneissli Krause

2(1) Tarsi IV ending in 2 strong macrosetae.

3(4) Distal joints of gnathosoma each bearing 2 setae (arists); a white oval mark on each of the anterior angles of the hysterosoma no doubt represents an eye with a feebly convex lens; sucking disc

bordered by a very wide, free membrane. Germany.

18. C. (?) zacheri Ouds.

4(3) Distal joints of gnathosoma each bearing 1 long seta (arist); no eye-like mark in the anterior angles of the hysterosoma; sucking disc without a free membranous border.

5(16) Ventrum absent; legs IV extremely short, barely equal to 10 to 11% of the length of the idiosoma; tarsi IV distinct from the tibiae and almost spherical or fused with them to form a short tibiotarsus, rounded at the end; legs II not exceeding 18% of the length of the idiosoma; their tarsi not longer than the femora.

6(13) Dorsal plates distinctly striated longitudinally or reticulate in the same direction; retinae spearate, arched.

7(8) Ventral setae of tarsi I and II extremely short, simple; apical setae of tibiae I and II very long, extending a long way beyond the end of the ambulacrum; arists short, their ends reaching only to the base of tibiae I; dorsal shields longitudinally striated. East Africa, Italy.

15. C. striata Vtz.

8(7) Ventral and internal apical setae of tarsi I and II large, leaflike and lanceolate; apical setae of tibiae I and II shorter, barely extending beyond the end of the ambulacrum.

9(10) Idiosoma shaped like a regular ellipse, widely rounded posteriorly; dorsal shields with a coarse reticulate pattern; arists shorter, their ends only reaching the base of tibiae I. On Ips acuminatus Eichh.

17. C. elliptica sp.n.

10(9) Idiosoma fusiform or almost oval, narrowing like a parabola towards its posterior end; dorsal shields densely and regularly striated longitudinally over their entire surface or ornamented at wider

intervals along the median line of the body to give rise to longitudinal depressions; arists long, reaching the base of tarsi I.

11(12) Idiosoma fusiform, narrowing strongly and regularly towards the anterior and posterior ends, 1.7 times longer than wide; antero-lateral borders of the propodosomal shield regularly and feebly convex over its entire length; rostrum barely marked; the entire surface of the dorsal shields densely and regularly striated. On Blastophagus. U.S.S.R. (Moscow region).

14. C. fusiformis sp.n.

12(11) Idiosoma almost oval, 1.45 times longer than wide, narrowing less sharply towards its posterior end; antero-lateral edges of the propodosoma sinuous, forming distinct depressions behind the eyes, and thus limiting the elongated rostrum; dorsal shields more feebly striated in the mid-dorsal line (especially on the propodosomal shield), thus forming here a coarse closed network. On Hylesinus. U.S.S.R. (Moscow).

16. C. nataliae sp.n.

13(6) Dorsal shields smooth; retinae united at their anterior ends.

14(15) Praetarsi shaped like a long, elongated stalk; tarsi I to III with 4 large lanceolate setae. On Ips stebbingi Stroh. Tibet.

12. C. circumspectans Vtz.

15(14) Praetarsi forming a short stalk, tarsi I and II with 2 lanceolate setae, tarsi III devoid of such setae. Holland.

13. C. hagensis Ouds.

16(5) Ventrum well-developed; legs IV less shortened, reaching 15 to 20% of the idiosoma in length, their tarsi fused with the tibiae, forming an elongated, more or less cylindrical tibiotarsus, which generally widens towards its truncate end; or clearly separated from

the tibia and then much longer than wide; legs III 30 to 33% of the length of the idiosoma, rarely shorter (in C. calliphorae and C. bulgarica almost 22%); tarsi 1.5 times longer than the femora.

17(18) Legs I and II much elongated (45 to 55% of the length of the idiosoma) and thin; tarsi I almost 6 times longer than wide at the base, tibiae twice as long as the basal diameter; idiosoma much elongated, shaped like an amphora; ventral shield narrow, 1.7 times longer than the distance between the insertions of legs III, ornamented with distinct thickenings on its posterior edges; sensory club of tarsi I and II short, separated from the base of the tarsus by a distance equal to its length. Bulgaria, U.S.S.R. (Tartary).

9. C. thraca Vtz.

18(17) Legs I not more than 40%, legs II 36 to 38% of the length of the idiosoma; tarsi I not more than 3.5 times, tibiae not more than 1.7 times longer than their basal diameters; idiosoma different in shape, wider; ventral shield not more than 1.3 times longer than wide, not encircled posteriorly by marginal thickenings; sensory club generally long, near the base of the tarsus.

19(22) Propodosomal shield only 1.5 times shorter than the hysterosomal; legs III short, not more than 16 to 22% of the length of the idiosoma; tarsi IV fused with the tibiae to form a tibiotarsus; setae of the tibiae and tarsi I and II, as well as the olfactory club, short; idiosoma 1.5 to 1.6 times longer than wide.

20(21) Anterior macroseta of legs IV strongly thickened, twice as thick as the posterior (internal); tibiotarsus IV bifurcate distally; retinae fused to form a round, pigmented patch; posterior end of body evenly rounded. Bulgaria, U.S.S.R.

11. C. bulgarica Štorkán.

21(20) Anterior macroseta of legs IV not thickened (thinner than the

posterior one); tibiotarsus IV truncate distally; retinae fused to form a kind of dark-coloured λ-shaped figure; posterior end of body almost straight. Germany.

C. calliphorae Vtz.

22(19) Propodosomal shield twice as short as the hysterosomal; legs III reaching a length of 30 to 32% of the idiosoma; tarsi IV distinct from the tibiae; setae of tibiae and tarsi I and II, as well as the sensory rod, very long; idiosoma wide, 1.25 to 1.4 times longer than wide, rounded posteriorly.

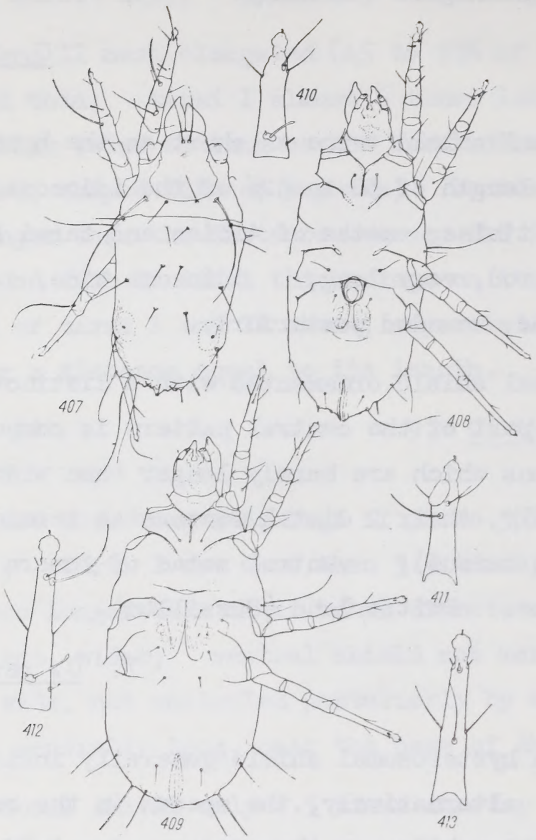
23(24) Hysterosomal shield ornamented with a distinct reticulate pattern; one part of the central pattern is composed of pentagons and hexagons which are barely longer than wide; tarsi IV truncate distally, their 2 distal macrosetae terminal (on the truncate end of the tarsus); ventral setae of femora I and II extremely long and fine. Switzerland (Sussillon).

7. C. reticulata sp.n.

24(23) Pattern on hysterosomal shield generally indistinct (on mounted preparations); alternatively, the spaces in the reticulate network when visible are much longer than wide; tarsi IV terminating obliquely; one of the macrosetae (the shortest) is distinctly more proximal than the other; ventral setae of femora I and II of medium length.

25(26) Idiosoma very wide, only 1.25 to 1.3 times longer than wide, widely rounded posteriorly; epimerites II strong, very distinct; distance between the eyes equal to the diameter of the cornea; praetarsi III with a short stalk and a large elongated lamella. A smaller species, of length 170 to 180μ. England, Holland, U.S.S.R. (extreme east).

2. C. heterocoma Mich.



Figs.407 - 413. Calvolia tuberculata, sp.n.

Fig.407 - ♂, dorsal surface. Fig.408 - Ditto, ventral surface.
Fig.409 - ♀, ventral surface. Fig.410 - Tarsus I, ♂, dorsal view.
Fig.411 - Ditto, ventral view. Fig.412 - Tarsus I, ♀, dorsal view.
Fig.413 - Ditto, ventral view.

26(25) Idiosoma narrower, 1.4 times longer than wide, with a curved posterior end; epimerites II indistinct; distance between the eyes is twice as wide as the diameter of the cornea; praetarsi III with an elongated stalk and a rounded lamella. Length 200 to 220μ. U.S.S.R. - Caucasus, Bouchara.

6. C. elisabethae sp.n.

1. Calvolia tuberculata sp.n. (Figs. 407 to 413.)

Its colour, when alive, is unknown. The cuticle is smooth on the anterior three-quarters of the idiosoma and slightly striated on the remaining quarter (particularly on the ventral and lateral surfaces). On the posterior edge of the body, there are a few small spherical protruberances. The propodosomal shield is clearly defined, very wide and with a semicircular posterior edge, which has 2 small excisions laterally. Sc i are 3.3 to 3.6 times shorter than sc e; h e are 2 to 2.5 times longer than h i, whose length barely exceeds that of d_1; sa e are noticeably shorter than l a and l p, the latter being twice as long as the remaining setae of the idiosoma; the 4 pairs of dorsals are short, straight setae. The longer setae of the idiosoma arise from small tubercles.

♂. The idiosoma is slender, more than twice as long as its maximum width, which is at the base of legs III; its lateral edges converge slightly from this point to the origin of l p, they then form a right angle and meet at the pointed end of the anal folds. On the posterior edge of the body, there are 6 circular protrusions, grouped together on either side of the anal slit. L p are fairly short, not longer than in the ♀. Epimeres IV are diagonally placed, forming a distinct obtuse angle with a thin sclerotised line joining them to the genital opening; the anterior edge of the latter is placed on the same transverse line as the posterior edges of acetabula III, its posterior edge on a level with the posterior edges of acetabula IV. Length 288 to 295μ, width 118

to 135μ; the total length of the body is 323μ.

♀. The posterior edge of the idiosoma has 2 small tubercles. All the apical setae of the tarsi are capilliform and unthickened; the median ventral seta of tarsi I and II is more distal than the sensory rod. Length 386 to 400μ, width 164 to 185μ; the total length of the body is 440 to 450μ.

The hypopial and other immature stages are unknown.

Distribution. It has only been recorded from the Karajazsk region of Georgia, U.S.S.R. A colony of this interesting species has only been found on maize seedlings under natural conditions; associated with it were T. farinae, T. tenuiclavus and others.

2. Calvolia heterocoma Mich. (Figs. 394, 403, 419, 420.)

Michael, 1903, 106, t. XXXIII (Tyroglyphus); Vitzthum, 1920, Arch. Naturg., LXXXVI, 10: 58 (Calvolia); Oudemans, 1927, Entomol. Ber., VII, 246 (Czenspinskia).

When alive, this species is light yellow or orange in colour (the variation in colour from yellow to orange is evidently connected with the nature of its food and habitat; those which Michael reared in captivity were much paler than those found under natural conditions; those found in spring were brighter in colour than the autumn forms. Colourless specimens are also found, but the light orange and yellow forms are more numerous, the colour being more pronounced than is usual for the Tyroglyphidae); the "fat" glands have red to bright yellow contents. The cuticle is absolutely smooth. Sc i are 2.3 times shorter than sc e and equal to h i; h i are half the length of h e, and almost twice as long as d_1, d_2 and d_3; sa e are noticeably longer than l a and l p, whose length, in the ♀, almost exceeds twice that of d_1, d_2 or d_3; all the dorsals are represented by short, slightly stiff setae. The approximate lengths of the setae of the idiosoma in the ♀ (according

to Michael's drawing) are v i 12, sc e 35, sc i 15, h e 30, h i 15, d_1, d_2 7, d_3 8, d_4 9 to 10, l a and l p 15 to 16, sa e 18 to 20, sa i 45 to 50% of the length of the idiosoma. In the ♂, l p are very long. The lengths of the remaining setae are unknown.

♂. The idiosoma is 1.7 times longer than its maximum width, which is at the level of l p, far behind the bases of legs IV; its lateral edges diverge up to this point, and then converge at a wide obtuse angle towards the anal protrusion. L p are very long, approximately half the length of the idiosoma. Epimeres IV are placed transversely and are almost continuous with the sclerotised line joining them with the genital opening; the latter is more posterior than in C. tuberculata, so that its anterior edge is considerably behind the posterior edges of acetabula III, and its posterior edge is on a level with femora IV. The total length of the body averages 280μ, its width 130μ.

♀. All the apical setae of the tarsi resemble hairs; the middle ventral seta of tarsi I and II is more distal than the main sensory rod. The total length of the body averages 350μ, its width 270μ.

Hypopus. This is easily distinguished from other species of Calvolia by its very wide idiosoma, whose posterior edge is rounded like a semicircle; its length is 1.25 to 1.3 times greater than its width. It is pale yellow in colour. The surface of the dorsal shields is covered with an indistinct reticulate pattern, whose undulating lines anastamose with one another to enclose elongated pits of irregular shape. All the setae of the dorsal surface are very short (they can only be seen under high magnifications). The propodosomal shield is 2.2 to 2.4 times shorter than the hysterosomal; behind the eyes, its antero-lateral edges are slightly concave, then become regularly and feebly convex, so that the rostrum is barely noticeable. The scapular setae are equidistant from one another and arranged to form an inverted trapezium, sc e being slightly posterior and external to the pseudostigmatic organ; sc i are much more posterior and internal, near the posterior edge of the shield;

sa i are noticeably internal to p a. The distance between the eyes is equal to the diameter of the lens; the retinae converge anteriorly at an obtuse angle and fuse together. The arists are of medium length, their ends extending as far forward as the middle of tibia I. The sternal shield is clearly defined laterally by the strong, slightly arched epimeres II; it has a very feebly marked straight posterior edge; the ventral shield is very wide, with a somewhat trapezoid anterior edge and without thickened edges in the posterior part. Epimeres IV are almost straight, converging almost at a right angle; where they meet they also fuse anteriorly with epimeres III. The ventrum is well-developed and extends almost as far back as the genital opening. The sucking disc is rounded, its lateral suckers on the same level as the central ones; the auxiliary ones are slightly larger than the laterals. The posterior edge of the sclerotised region of the disc is arched and the radial striations surrounding it are not obvious.

Legs I and II are fairly long (38 to 40, 35 to 37% of the length of the idiosoma) and of medium thickness; tarsi I are 3.5 and tibiae I 1.5 times longer than their width at the base. The ventral seta of the femur and tibia is fairly short; the tarsi are slightly swollen in their proximal half, becoming slightly narrower distally; the sensory rod of tarsus I exceeds half the length of the tarsus itself, it is very thin and cylindrical, and is placed at a distance equal to half its length from the base of the tarsus. Legs III are 28 to 30% of the idiosoma in length, their tarsi being 1.5 times longer than the femora; they bear fairly long simple setae, of which the 2 posterior ventral ones are close to the base of the segment. Praetarsi I to III are long, gradually narrowing towards the base. Legs IV are relatively longer (70% of the length of the idiosoma), their tarsi are clearly separated from the tibiae and are twice as long as their width at the base; they become noticeably wider distally and terminate in an obliquely truncate end; the shorter of the 2 macrosetae (the posterior one) is noticeably more proximal in position than the other. Length 170 to 180µ, width 130 to 140µ.

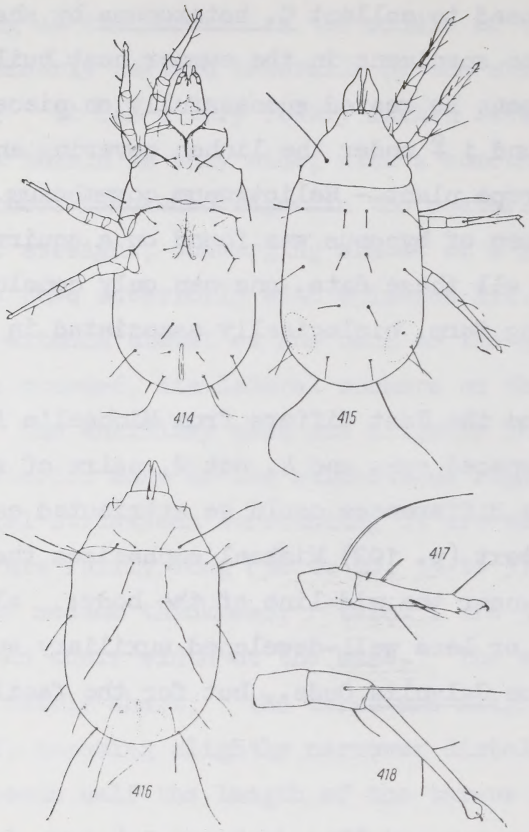
Distribution. England, Holland, U.S.S.R. (it was found only in the far eastern part, in the direction of Siberia).

Ecology. Michael used to collect C. heterocoma by shaking oak trees, and he found numerous specimens in the summer nest built by a squirrel. Some of these specimens he reared successfully on pieces of Boletus edulis L. Oudemans found 1 ♀ under the lichen covering an elm (in January), another on a heliotrope plant - Heliotropum corymbosum R. and Pav. - in December. My specimen of hypopus was found on a squirrel's fur (Sciurus vulgaris L.). From all these data, one can only conclude that C.heterocoma is a free-living form, biologically associated in some way with squirrels.

The hypopus from the East differs from Michael's figures 4 and 5 in having less widely spaced eyes and 4, not 2, pairs of suckers on the ventral disc, but these differences could be attributed easily to inaccurate drawing, as in the text (p. 102) Michael emphasises that the eyes are very close to each other near the mid-line of the body; also the number of suckers (8 + 2 more or less well-developed auxiliary suckers) is constant, not only in the genus Calvolia Ouds., but for the family Saproglyphidae as a whole.

3. Calvolia romanovae sp.n. (Figs. 414, 415.)

♀. When alive, this is whitish in colour, but slightly tinged with green. The cuticle is quite smooth. Sc i are 4.5 to 5.5 times shorter than sc e, whose length is 40 to 45% of the length of the idiosoma; h e are three times longer than h i; h i are equal to or slightly longer than d_2 and d_3; l a and l p are noticeably longer than any of the dorsals; sa e is shorter than l a and l p; d_1 to d_4, as well as sc i, h i, sa e, l a and l p are short, slightly stiff, straight setae. All the apical setae of the tarsi resemble hairs and are not thickened; the middle ventral seta of tarsi I and II is distal to the sensory rod. Length 308 to 350μ, width 150 to 180μ. Total length 355 to 380μ. ♂ and immature stages are unknown.



Figs.414 - 418

Fig.414 - Calvolia romanovae, sp.n., ♀, ventral surface. Fig.415 - Ditto, dorsal surface. Fig.416 - C. kamenskii, sp.n., ♀, dorsal surface (the legs have not been drawn). Fig.417 - C. kamenskii, sp.n., tibia and tarsus I, lateral view. Fig.418 - C. kamenskii, sp.n., distal three joints of leg IV, lateral view.

Distribution. It has only been recorded from Moscow, where 2 females were found, with T. farinae, on stored wheat.

This species is allied to C. heterocoma, from which it differs in having shorter sc i and sa e; there are other differences in length of setae and the size of the idiosoma.

4. Calvolia hebeclinii Sicher. (Fig. 421.)

Sicher, 1899, in. Canestrini, Prospetto d. Acarofauna Ital., VIII, 971, t. 99 (Glycyphagus).

Judging from the incomplete drawing and description, this species is allied to the preceding one in length of setae (sc e are about 50%, sc i and d_1 to d_4 10 to 12% of the length of the idiosoma); it differs from C. romanovae and all other species of the genus Calvolia by having a finely (not obviously) striated cuticle, which is particularly noticeable on the ventral surface of the body; also, only one of the apical setae of tarsi I and II is thickened and expanded distally, and the median ventral seta of the same tarsi is more proximal than the sensory rod. Total length of the body of the ♀ is 290μ, width 145μ. The ♂ is unknown. (As can be easily seen from his drawings, Sicher mistook the telonymph for the ♂.) The eggs are oval, whitish and sometimes swollen at either pole; the chorion is exceedingly thin and may sometimes be irregularly torn on the ventral side of the developing embryo; dimensions of the egg are 96 x 55μ.

The larva has short, circular "bruststiele". Its length is 147μ, its width 75μ. The hypopus is unknown.

Distribution. Sicily. It lives on a hothouse plant - Hebeclinium macrophyllum D.C. - which originates from the Antillian Islands, Guiana, Brazil, Peru and New Zealand. It usually clings to the lower surface of the leaves, more seldom to the flower, and rarely to other parts of the plant. The immature stages prefer withering leaves. The mite moves slowly.

5. Calvolia kamenski sp.n. (Figs. 416 to 418.)

♀. This is easily distinguished from other species of Calvolia on account of its larger size and considerably longer fine setae. The cuticle is absolutely smooth. Sc i are 2 to 2.3 times shorter than sc e and approximately equal to h i; the latter are about 2.5 times shorter than h e, equal to d_1 in length and noticeably (1.5 times) shorter than d_2 and d_3; sa e are obviously shorter than l a and l p which are slightly shorter than d_4 and do not exceed d_2 and d_3 in length; all 4 pairs of dorsal setae, as well as sc i, h i, l a, l p and sa e are very thin, flexible and longer than in other species. All the apical setae of the tarsi also resemble hairs and are unthickened; the middle ventral seta of tarsi I and II is distal to the main sensory rod; eta is shaped like a bristle. Length 380 to 440μ, width 230 to 260μ. The total length of the body is 430 to 510μ.

Distribution. It has been described from material found in Bashkeria (Sterlitamakskji - a collective granary). Two females were found in plant refuse on the nets of the combine.

6. Calvolia elizabethae sp.n. (Figs. 404, 405, 443.)

This is known only as the hypopus, which closely resembles C.heterocoma Mich. (it only differs in being larger, with a much narrower idiosoma; the relationship of length to width is 1.4:1). It is rather egg-shaped, with a narrowing posterior end, which is curved like a parabola. The reticulate pattern on the dorsal shields is composed of fairly regular indentations, which are elongated and hexagonal in shape; the setae arising from the dorsal surface are longer and better defined. The eyes are wide apart. The sternal shield is outlined posteriorly by an obtuse angular line; epimeres II are very feeble and only represented by a thin straight line, which outlines the sternal shield laterally; the posterior edge of the sclerotised sucking disc is a conspicuous projection, which is outlined laterally by a shallow depression. Praetarsi I to III each have

an elongated stem terminating in a round distal plate. The setae on the legs are much longer. Length 200 to 220μ, width 140 to 155μ.

Distribution. It has been described from material found in old Buhara on Ellobius talpinus Pall. To this species also probably belongs a badly-preserved specimen from Prometheomys shaposhnikovi Sat. from Gudaura.

7. Calvolia reticulata sp.n. (Figs. 428, 442.)

This is known only in the hypopial stage, which is very similar to the preceding one; it differs in the surface of the dorsal shields having a denser and more regular reticulate pattern, that on the hysterosomal shield is composed of pentagonal or hexagonal indentations which are almost equal in length and breadth. The distance between the eyes equals the diameter of the lens. All the setae of legs I to III are even longer and thinner than in the preceding species. The praetarsi are shorter, of almost equal diameter; tarsi IV are slender, almost cylindrical, becoming slightly wider towards their truncate apices; both macrosetae are terminal in position (placed on the straight distal edge of the tarsus). Length 235μ, width 155μ.

Distribution. Switzerland - Susillon. It was found on the bee Osmia (Anthocopa) dalmatina F.Mor.

8. Calvolia kneissli Krausse.

Krausse, 1919, Arch. Naturg., LXXXIII, 10: 123, figs. 1 to 7.

I have not found this myself. Judging from the imperfect and superficial description of Krausse, it is closely allied to C. reticulata and other species of the C. heterocoma Mich. type in having a distinct reticulate pattern on the wide dorsum,and long ambulacra; it differs from all other species in that tarsus IV bears only 1 macroseta instead of 2 shorter and 2 longer.

Ecology. It was found in large numbers on Ips laricis.

9. Calvolia thraca Vtz. (Figs. 432, 447, 448.)

Vitzthum, 1922, Zool. Jahrb. Syst., XLIV, 542, figs. T to U.

Hypopus. This is easily distinguished from other species on account of the peculiar shape of the body and very long anterior legs. It is a dull brown in colour, the distal end of the gnathosoma being somewhat darker. The idiosoma is 1.65 to 1.7 times longer than its width; it is shaped like an amphora, narrowing sharply towards its strongly extended posterior end, which projects backwards like a tongue; the lateral edges of the hysterosoma are convex up to the level of the bases of legs IV, then they become conspicuously concave, thus giving the body its characteristic shape. The surface of the dorsal shields is longitudinally striated, the striations not so thickly or so clearly defined as in C. striata. The propodosomal shield is 2.5 times shorter than the hysterosomal and has well marked scapular protrusions; its slightly indented anterior lateral edges form clear indentations on either side of the rounded rostrum; sc are arranged in a feeble anteriorly concave arc, the distance between the sc i setae being twice that separating each seta from sc e. The retinae are fused in the mid-line to form an angular, darkly pigmented shape. The arists are very long.

The sternal shield is shaped as in C. fusiformis, but it is less elongated. Epimeres III form an almost regular semicircle, their anterior edges being separated by a considerable distance from the posterior edge of the sternal shield; epimeres IV are normal in structure and the ventrum is long; the posterior parts of the lateral edges of coxal fields IV are narrowly thickened. The sucking disc is small, the posterior edge of its sclerotised plate being convex; the ventral suckers are considerably larger than the lateral and posterior ones, which are equal in size; the anterior suckers are very small, whilst the auxiliary are larger than the lateral ones.

Legs I and II are very long (55 and 40% of the length of the idiosoma), and slender; tarsi I and II are twice as long as the preceding segment (tibia) and 5.5 times (tarsus I) or 4 times (tarsus II) longer than their diameter at the base; their proximal two-fifths are of even diameter, then they narrow suddenly towards their distal ends. Both ventral setae of tibia I and II and the external seta of the genu are long; the sensory rod is very short, straight and narrow distally; it is far removed from the base of the tarsus. The dorsal apical seta is not very long and is slightly widened at its end; the external apical and both antero-ventral setae are short, simple and resemble hairs; the postero-ventral seta and eta are long. Legs III are slender, considerably longer than in other species (about 30% of the length of the idiosoma); their tarsi are longer than the combined length of the genu and tibia and bear fairly long, simple setae; there are no leaf-like setae arising from them. Praetarsi I and III are very long, with a thin elongated stem and rounded or almost rhomboid distal plate. Legs IV are 16% of the idiosoma in length, the tibia and tarsus are fused into a non-segmented cylindrical tibio-tarsus, which is sharply oblique at its distal end; the external (anterior) macroseta is much shorter than the apical one and more proximal in position. Length 185 to 200μ, width 110 to 125μ.

Distribution. Bulgaria, near Sofia and in the U.S.S.R. (Ajrezskye region of Tartary).

Ecology. This species was found by Vitzthum on a small metallic green fly, which was not described in more detail; my specimen was found in dung from a collective farm.

10. Calvolia calliphorae Vtz. (Figs. 422, 423.)

Vitzthum, 1922, Zool. Jahrb., Syst., XLIV, 539, figs. P to Q.

Hypopus. This is a light yellow in colour, the tip of the gnathosoma being a dark brown, the legs pale yellow. The idiosoma is 1.6 times

longer than its maximum width; its posterior edge is almost truncate, its anterior pointed; the lateral edges of the hysterosoma are almost straight. The surface of the dorsal shields is almost smooth; the propodosomal shield is 1.5 times shorter than the hysterosomal, with only slightly marked scapular protrusions and straight anterior lateral edges; sc are arranged in the shape of an arc which is strongly convex anteriorly; sc i are considerably anterior to sc e and the distance between the 2 setae of this pair is almost twice that separating each from sc e. The retinae are fused into a darkly pigmented ∧ -shaped figure. The arists are short, barely projecting, with their tips beyond a line drawn through the bases of tibiae I. The sternal shield is wide, with feebly outlined edges and a curved posterior edge; epimera III, as usual, form an arc, whilst epimera IV are fused along the mid-line of the body; they differ, however, from other species in being separated by a considerable distance from epimera III, so that coxal fields III remain open; the ventrum is short, but quite clear. The sucking disc is elongated transversely, the posterior edge of its sclerotised plate being wavy and having a rounded median projection, which is separated from the arched lateral edges by small serrations; the lateral suckers are almost the same size as the central ones, whilst the auxiliary suckers are larger than the posterior. The posterior edge of the cushion surrounding the sucking disc is almost straight, ornamented with thin radial striations, which extend noticeably beyond the posterior edge of the hysterosoma.

Legs I and II are medium in length (40 to 38% of the length of the idiosoma) and fairly massive; tarsi I and II are 1.5 times longer than the tibia, thin, conical, becoming wider towards the base, and each having a projection on its ventral side; the ventral setae of the tibia (according to Vitzthum's drawing) are not represented, perhaps they are absent. The sensory rod of tarsi I and II is short, bent, and arises near the base of the tarsus; the dorsal apical seta is very long and resembles a hair; the ventral and external apical setae are very short, none of them is leaf-shaped. Legs III are medium in length (about 25%

of the idiosoma), slender, with a fairly long tarsus which considerably exceeds the length of the tibia; the dorsal apical seta of tarsus III is short, and here also, leaf-shaped setae are absent. The praetarsi of legs I to III are short, each with a short stalk. Legs IV are 16% of the length of the idiosoma, the tarsi and tibiae fused into a non-segmented tibiotarsus, this widens greatly towards its truncate end, which bears long macrosetae; of these the external (anterior) one is only slightly shorter than the internal. Length 208μ, width 106μ.

Distribution. Germany (Weimar), it was found once on a bluebottle - Calliphora vomitoria L.

11. Calvolia bulgarica Störkăn. (Figs. 424, 425.)

Störkăn, 1935, Vestn. ceskoslov. zool. spolecn., II, 92, 3 figs.

Hypopus. This is closely allied to C. calliphorae Vtz., but is easily distinguished from all other species by the retinae being fused to form 1 round "eye" and also by the very long, strongly thickened anterior macroseta on legs IV. It is a light yellow-ochre in colour. The idiosoma is 1.5 times longer than its width, approximately pentagonal in shape, with a semicircular posterior end. The surface of the dorsal shields is finely wrinkled posteriorly, particularly along the edges of the hysterosoma. The propodosomal shield is 1.5 times shorter than the hysterosomal, with almost regularly convex lateral edges (on a slightly flattened preparation) which converge in a gentle curve towards the anterior end. Sc i are close together and situated at a considerable distance from the posterior edge of the shield; the retinae are fused to form a rounded, deeply pigmented area, and the arists are fairly short. The sternal shield is clearly outlined laterally by the slightly arched epimerites II, and has no noticeable posterior margin; epimeres III are united in the mid-line of the body with a longitudinal strut, to which epimeres IV are also joined; the ventrum is fairly long. The sucking disc is transversely elongated and sclerotised, its posterior

edge shaped like a bracket; the auxiliary suckers are the same size as the central ones, whilst the peripheral are noticeably smaller.

Legs I and II are fairly massive and short, 36 to 34% of the length of the idiosoma, the tarsi almost twice the length of the tibiae and broadening like cones towards their bases; the ventral setae of the tibia are short (on tibia I the external seta is absent). The sensory rod of the tarsi is expanded distally, fairly short (particularly on tarsus I) and inserted near the base of that segment; the external and internal ventrals and the external apical setae are fairly long, strong and simple. Legs III are very short (60% of the length of the idiosoma), with a fairly long tarsus, this exceeds in length both tibia and femur, and has no leaf-shaped setae. Praetarsi I to III are short and have very short stalks; the claws are fairly large. Legs IV are about 15% of the length of the idiosoma, the tarsus fused with the tibia to form an unsegmented tibio-tarsus which is much longer than the femur and widens considerably towards its forked end; both of the terminal macrosetae are very long, the anterior (external) one being much thicker than the posterior (at its base it is twice as thick). Length 207μ, width 140μ.

Distribution. Bulgaria, Central Balkans; it has also been found near Smolensk on a flea - Aphtona euphorbiae - the flax flea - by V.I. Volgin.

12. Calvolia circumspectans Vtz. (Fig. 406.)

Hypopus. This is yellow ochre in colour. The idiosoma is 1.7 times longer than its maximum width, pointed at both ends and sharply narrowing from the conspicuous anterior angles of the hysterosomal shield. The surface of the dorsal shield is very smooth, the propodosomal shield is almost half the length of the hysterosomal; sc setae are arranged in an anteriorly convex arc, and are equidistant from each other. The retinae are fused to form a Λ-shaped darkly pigmented figure. The arists are long, extending as far forward as the base of tarsus I. The sternal

shield is wider than its length, very clearly outlined laterally by epimerites II, which curve inwards; the posterior edge is almost straight and thickened, it is fused with epimeres III; epimeres IV join medially with a longitudinal strut to form a Λ-shape; a ventrum is absent. The sucking disc is rather large and heart-shaped, the auxiliary suckers feebly developed.

Legs I and II are medium in length (36% of the length of the idiosoma) and fairly slender; the tarsi are almost twice the length of the tibiae, each is about 2.5 times longer than its diameter at the base and narrows towards its end; the ventral setae of the tibia are not shown in Vitzthum's drawings; the sensory rod is thin and straight, it exceeds half the length of the tarsus on legs I or is equal to the length of tarsus II and is inserted right at the base of the joint; the anterior ventral and both apical setae (the internal and the dorsal) are expanded like leaves and are long. Legs III are fairly short (80% of the length of the idiosoma), of medium thickness and have a relatively long tarsus (almost equal in length to the femur), which bears distally 4 leaf-shaped setae. Praetarsi I to III each have a long stalk and an oval apical plate; legs IV are very short (10% of the length of the idiosoma), with a semi-spherical tarsus clearly distinct from the tibia; the apical macroseta is almost equal in length to the idiosoma; the internal one is half its length. Length 175 to 181μ, width 105 to 111μ.

Distribution. It has only been found in Tibet. The hypopi were found on a bark-boring beetle - Ips stebbingi Strohm.

13. Calvolia hagensis Ouds.

Oudemans, 1911, Entomol. Ber., III, 187.

Hypopus. I have not seen this species. Oudemans' original description is - length 185μ, width 100μ. The proterosoma is more than one-third the total length of the body (65μ), almost triangular in shape; at its anterior end are 2 eyes (similar to those of the hypopus of T. heterocomus

Michael), whose retinae are reddish-brown in colour. The legs are thin, but not so thin as those of Anoetus; tibia I has a long, and tibia II a very long, sensory seta, tarsus IV terminates in 2 long setae ("sleepharen"). This incomplete description is enlarged by Vitzthum, who evidently had access to Oudemans' unpublished drawings. According to Vitzthum, this C. hagensis is closely allied to C. circumspectans and the description of the structure and the size of the 2 species is almost the same in all details. An important difference is that in the hypopus of C. hagensis, the ambulacra are not so disproportionately long and they are surrounded by only 2 leaf-shaped setae on tarsi I and II. Tarsus III does not possess such setae and tarsus IV, in the Dutch variety, has fewer than the one from Central Asia.

Distribution. Holland, near the Hague; it was found in decaying leaves of woods.

14. Calvolia fusiformis sp.n. (Figs. 429, 430, 445.)

Hypopus. This is a light yellow-ochre in colour. The idiosoma is elongated and spindle-shaped, its outline is regular and it narrows towards the anterior and posterior ends; its length is 1.8 times the maximum width (which is in the middle of the body). The surface of the dorsal shields is covered with thick, longitudinal striations, which have numerous branches, but rarely anastamose to form a closed network. The propodosomal shield is very long, three-quarters of the length of the hysterosomal shield; sc are arranged in an almost regular transverse row, the distance between the sc i setae being 3 times greater than that separating each from sc e. The retinae are curved and separate from one another. The arists are very long, their ends extending as far forward as the middle of tarsi I. The sternal shield is longer than its width, well-defined, with feebly projecting lateral edges, which form a strongly rounded, yet clearly marked angle with the rounded, but angular, posterior edge; epimeres III are distinct. The sucking disc

is small, its posterior edge densely sclerotised to form a distinct central projection; curved lines from this projection join it with the rectangular lateral edges; the auxiliary suckers are small and feebly developed, the radial striations around the sucking disc are not noticeable.

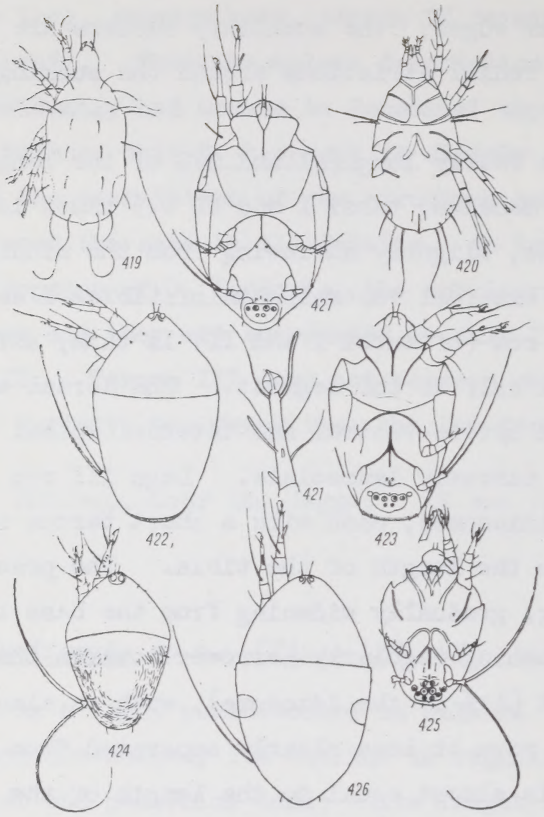
Legs I and II are fairly long (41 and 37% of the length of the idiosoma); they are massive, tarsi I and II 1.5 times longer than their respective tibiae, slightly narrowing from the middle towards the distal end. The external ventral seta of tibiae I and II is absent; the sensory rod (of tarsi I and II) is thin, straight and placed in the proximal half of the segment. The dorsal apical seta is simple, whilst both antero-ventral and internal apical setae are enlarged distally and narrowly lanceolate. Legs III are short (15% of the length of the idiosoma), each with a short tarsus which is approximately equal to the length of the tibia. The praetarsi of legs I to III are long, gradually widening from the base to the distal third and then becoming regularly narrower towards the claw. Legs IV are very short (11% of the idiosoma), with an almost spherical tarsus, which is more or less clearly separated from the tibia; the apical macroseta is almost equal to the length of the idiosoma, whilst the anterior one (external) is shorter than half the length of the idiosoma. Length 180μ, width 105μ.

Distribution. This description is based on 1 specimen found on a bark-boring beetle - Blastophagus minor Ratz., which was found at Klin, near Moscow.

15. Calvolia striata Vtz. (Figs. 426, 427.)

Vitzthum, 1914, Zool. Anz., XLIV, 324, fig. (Vidia); 1922, Zool. Jahrb. Syst., XLIV, 539, figs. R to S (Calvolia).

Hypopus. This is very similar to the preceding one, but the idiosoma is less fusiform in shape, and it narrows less markedly towards the



Figs.419 - 427.

Fig.419 - Calvolia heterocoma Mich., ♀, dorsal surface (after Michael). Fig.420 - Ditto, ventral surface (after Michael). Fig.421 - C. hebeclinii Sicher, tarsus I, ♀, (after Sicher). Fig.422 - C. calliphorae Vtz., hypopus, dorsal surface (after Vitzthum). Fig.423 - Ditto, ventral surface (after Vitzthum). Fig.424 - C. bulgarica Storkán, hypopus, dorsal view (after Storkán). Fig.425 - Ditto, ventral view (after Storkán). Fig.426 - C. striata, Vtz., hypopus, dorsal view (after Vitzthum). Fig.427 - Ditto, ventral (after Vitzthum).

posterior end; the propodosomal shield is also slightly shorter, nearly half the length of the idiosoma. The arists are much shorter, their ends not extending as far forward as the base of tibia I. The posterior edge of the sucking disc is semicircular. Tarsi I and II are longer and thinner, tarsus I exceeding twice the length of the preceding tibia; the sensory rod is shorter and more massive, the apical dorsal seta is shorter and does not reach beyond the end of the claw; the ventral and internal apical setae are extremely short and simple (not lanceolate); legs III are shorter than those of C. fusiformis, with a ring-shaped genu and tibia; on legs IV the tarsi and tibia are fused to form an unsegmented tibio-tarsus; the macrosetae of tarsi IV are shorter, the longest not exceeding three-quarters the length of the idiosoma. Length 168 to 182μ, width 91 to 101μ.

Distribution. West Africa (the elephant coast); later, it was found in Italy.

Ecology. The hypopi were found on bark-borers - Taphrorhynchus sp. (Italy) and Pityogenes lepidus Wichm. (Africa). Quite possibly, Vitzthum is here confusing 2 species.

16. Calvolia nataliae sp.n. (Figs. 431, 446.)

Hypopus. This is closely allied to C. fusiformis and C. striata. The idiosoma is noticeably wider (only 1.5 times longer than its width), rather egg-shaped; the lateral edges of the propodosoma form a longer rostrum than in related species (the outline of the propodosoma as a whole reminds one of the propodosoma of C. thraca); the hysterosomal shield has freely protruding angles and it narrows posteriorly less sharply than in C. fusiformis. The striations of the dorsal shield are less regular and less dense along the mid-line of the body, where they anastamose to form a wide "net" with an irregular, reticulate pattern; sc i are nearer to each other, the distance between them is only twice that between each of them and sc e; the arists are shorter, their ends

only reaching to the bases of genua I. The sucking disc is larger, the posterior edge of its sclerotised plate is curved. The ventral seta of the femur is long; the sensory rod of tarsi I is much shorter and its distance from the base of the tarsus greater than its own length. The praetarsus is almost linear, hardly widened at its end. Length 192μ, width 121μ.

Distribution. It was described from material obtained from the surroundings of Moscow (the village of Alekseevskoe); it was found on a bark-borer - Hylesinus fraxini Pnz.

17. Calvolia elliptica sp.n. (Figs. 60, 61, 444.)

Hypopus. A light yellow-ochre in colour. The idiosoma is a very regular elliptical shape, the posterior end widely rounded; it is 1.5 times longer than its width. The surface of the dorsal shields is covered with a conspicuous pattern, this consists of wide, elongated reticulations, which are partly open; the propodosomal shield is 1.5 to twice as short as the hysterosoma, its anterior lateral edges are evenly convex along their whole length and the rostrum is inconspicuous; sc are arranged in a transverse row, which is strongly convex anteriorly; the distance between the sc i setae is twice that between each and sc e. The retinae are arched and separate from one another. The arists are long, extending as far forward as the base of tarsus I. The sternal shield is shorter than its width, outlined posteriorly by a line shaped like a trapezoid; epimerites II are shapeless; the ventral shield is fairly wide and is posteriorly outlined by distinct edge thickenings; epimeres IV are, on the whole, arched, converging anteriorly at a very sharp angle and joined to epimeres III by a communal stem; the ventrum is absent. The sucking disc is fairly large and rounded, the lateral suckers slightly posterior to the central ones, the auxiliary noticeably larger than the lateral ones; the sclerotised plate of the disc consists of 3 almost distinct, bean-shaped sclerites and no visible radial

striations surround it.

Legs I and II are medium in length (34 and 32% of the length of the idiosoma) and slender, the tarsi slightly narrow towards the apex; the ventral seta of the femur is very long and the external ventral seta of the tibia absent; the sensory rod is slightly arched, feebly thickened distally and placed at a distance not exceeding half its length from the base of the tarsus; eta is slightly thickened at the end and delta is very small and close to alpha; both anterior ventral and internal apical setae are fairly long and lanceolate. Legs III are 18% of the idiosoma in length, their tarsi noticeably shorter than the femur and bearing 4 lanceolate setae. Praetarsi I to III are fairly long, each gradually widening towards its oval apex. Legs IV are very short (12% of the length of the idiosoma) and thick, their tarsi very short and more or less clearly spearated from the tibiae; each is obliquely truncate at its free end, so that the shorter of the 2 macrosetae is noticeably more proximal than the other. Length 180 to 190μ, width 118 to 120μ.

Distribution. It has only been found in Moscow (Sviblovo), where 3 hypopi were found on Ips acuminatus Eich.

18. Calvolia (?) zacheri Ouds.

Oudemans, 1930, Entomol. Ber., VIII, 36.

Hypopus. Length 190 to 200μ, width 125 to 135μ. It is elliptical in shape, the edges of the body above coxae I and II are very slightly concave. The transverse line separating the propodosoma and hysterosoma is approximately one-third the length of the body. Both eyes are near the vertical setae, which are ventral in position and equal to the combined length of femur and genu I. The other setae are very short and difficult to see, except those arising from the posterior edge, which are shorter than the vertical setae. It is yellow-brown in colour, the anterior edge of the hysterosoma whitish, and the "fat" glands (which are

about midway along the body) are dark brown. On the anterior angles of the hysterosoma is an oval white spot, which evidently represents the eye with its feebly convex lens. Ventrally, there are neither suckers, nor setae on coxal fields I and II. There is no sign of a genital opening or of the 4 internal genital "suckers". The 2 small suckers, which are normally placed near the genital opening, are in the middle of coxal fields IV. There are no radial striations on the very wide membranous free edge of the sucking disc. The gnathosoma is very short, not visible from above, each of its distal segments bears 2 long setae. On all the legs, the femur and genu are clearly separated; the praetarsi have 3 segments (according to Oudemans).

Distribution. Germany (Berlin), where it was found on mouldy cheese.

5. Genus Ensliniella

Vitzthum, 1925, Dtsch. Entomol. Ztschr., IV, 289.

Type species: Ensliniella parasitica Vtz. 1925.

The basal part of the chelicera is expanded, it narrows distally to form a thin spike (representing an exceedingly fine, immovable digit). The idiosoma is moderate in length; the propodosomal shield is quite distinct and has a deep lateral indentation on either side (anterior to the middle of the shield) and cellular reticulations along the posterior edge. The two pairs of scapulars are equal in length and are slightly shorter than the setae arising from the hysterosoma; these are equal in length (30 to 40% of the length of the idiosoma) and project at right angles to the rest of the body; d_1 are closer to each other than to h i, and d_2 are considerably further apart than are the d_1 setae; d_3 are also wide apart (much nearer to the lateral edges of the body than to the mid-line) and are considerably displaced posteriorly; d_4 are also wide apart, dorsal in position, and a considerable distance from the posterior edge of the body; l a are approximately at the same level

as d_2, and 1 p and d_3 form a transverse row across the body; both pairs of laterals arise dorsally at a noticeable distance from the edges of the idiosoma; sa e are nearer to d_4 than to 1 p, and sa i are well-developed and terminal in the ♂; in the ♀ they are displaced on to the dorsal surface. The coxal sternal skeleton is feebly-developed, with a V-shaped sternum; epimeres II are slightly arched and have exceedingly narrow apodemes; epimeres III are much shortened and epimeres IV are more strongly developed than the others; they are S-shaped and, at their ends, bent anteriorly to form hooks.

The legs are slender and medium in length; the ventral setae of the tibia are long; the tarsi are long and have no terminal setae (or else the setae are so small as to be invisible); the apical setae of the tarsi are shorter than the tarsus itself; delta is absent and eta is capilliform; the praetarsi are large, with bell-shaped ends and a very small claw.

♂. Tarsi I and II are not modified; legs III and IV are unthickened; the genital opening lies between the bases of legs IV; the anal slit is displaced from the posterior edge of the body at a distance exceeding its length.

♀. The genital opening is placed between the base of legs III and epimeres IV, and has a well-developed epigynium; the anal slit is slightly displaced from the posterior edge of the body. The nymphal stages are unknown.

Hypopus. The body is elongated, egg-shaped and narrow; the dorsal shields are ornamented with an indistinct pattern of fine pits; the propodosomal shield is half the length of the hysterosoma and the apex of the rostrum has a pair of strongly convex semi-spherical eyes, with well-developed sclerotised retinae; along the edges of the hysterosomal shield, there are open narrow regions of soft membranous cuticle; a sclerotised apodeme arises from the middle of the posterior edge and extends forwards. The gnathosoma is completely reduced and represented

only by arists. Epimerites II are joined to epimeres III; the ventral shield is strongly elongated and has very marked lateral thickenings posteriorly; the ventrum is well developed. The sucking disc is almost terminal and surrounded by a wide transparent edge, capable of freely expanding and contracting, the suckers can also be protruded a long way from the body.

Legs I and II are long and slender, the tarsi bearing 3 setae shaped like leaves; eta is a long, thick, straight seta and delta is usually absent, but is sometimes replaced by a round pore. Legs III and IV are very short and thick, with extremely powerful trochanters. Legs IV are much displaced towards the end of the body and the greater part of them projects beyond its edge; tarsi III have 3 or 4 leaf-shaped setae and sometimes a large finger-shaped spine; tarsi IV are very short and armed with 1 thick, digitiform spine, 1 even longer spine - which resembles a scale and whose end is drawn out into a thin process, 2 long setae and a very small one; the largest of these setae - the macroseta - arises from a raised oval projection.

To the genus Ensliniella belong 2 closely related species which live in the nests of solitary wasps of the subgenus Lionotus of the genus Odynerus (one of these species is only known as the hypopus).

Ensliniella Vtz.

Hypopi

1(2) Tarsi III considerably shorter than their ambulacra, armed with a digitiform spine, similar to that on tarsi IV, and with 4 lanceolate setae; eyes almost joined; marginal thickenings of ventral shield arched, united with the sclerites which surround the anterior suckers; a membranous border surrounding the sucking disc is very wide. On Odynerus (Lionotus) floricola Sauss. Germany, U.S.S.R. (Armenia, Ouzbekistan).

1. E. parasitica Vtz.

2(1) Tarsi III equal in length to their ambulacra, without a digitiform spine, with only 3 lanceolate setae; the distance between the eyes is equal to the diameter of the lens; marginal thickenings of the ventral shield angular, not joined with the sclerites surrounding the ventral suckers; the membranous border surrounding the sucking disc is very narrow. On Odynerus (Lionotus) rossii Lep. U.S.S.R. - White Russia, the Crimea (Karadagh).

2. E. kotsylevi sp.n.

1. Ensliniella parasitica Vtz. (Figs. 380 to 384, 402, 436 to 440.)

Vitzthum, 1925, Dutch Entomol. Ztschr., IV, 289.

White in colour, the gnathosoma, legs and epigynium in the ♀ being pinkish. The idiosoma is fairly massive, 1.7 to 1.8 times longer than its maximum width, which is at the base of legs IV; the lateral edges of the hysterosoma along the whole of their length are feebly convex, the scapular angles being feebly marked. The posterior edge of the propodosomal shield has a transverse row of irregular reticulations and sc i are slightly posterior to sc e; sa e are much shorter than the remaining setae of the hysterosoma (except for the sternals and anals). The sensory rod of tarsi I and II is thin and long, arched and tapering distally.

♂. The setae of the idiosoma are slightly longer than in the ♀; d_1 to d_3 are noticeably shorter than the scapulars and, more particularly, than the long laterals; the approximate length of the setae (calculated from Vitzthum's figs. 4 and 5, and expressed as a percentage of the idiosoma) are: v i 18, sc e and sc i 31, h e and h i 35, d_1 29, d_2 and d_3 31, d_4 35, l a 37, l p 40 to 41, sa e 16, sa i 31, p a 33. All 4 legs are of approximately the same length, 41 (I,II), 40 (III), 43 (IV) % of the length of the idiosoma. Length 470μ, width 260μ.

♀. The setae of the idiosoma are shorter and of more uniform size;

their lengths are: v i 14, sc e and sc i 27 to 29, h e, h i, d_1, d_2, d_4 31, d_3 25, l a and l p 29, sa e 19, sa i 26, p a 30%. The difference in length of leg is more pronounced, their respective lengths being 35 (I), 34 (II), 37 (III), 41 (IV)% of the length of the idiosoma. Length 610μ.

Hypopus. The eyes almost touch in the mid-line of the body. The hysterosomal shield is slightly narrower than in the next species and becomes even narrower posteriorly; sc form an almost straight transverse row; the longitudinal sclerotised apodeme extends anteriorly beyond the level of d_4. The arists are very short. The ventral shield is very narrow, 1.7 to 1.75 times longer than its width between the origins of legs III; the ventrum is shorter, the thickenings along its posterior edge are joined and fused with the closed sclerotised framework encircling the anterior suckers. The external suckers are noticeably anterior to the central ones, and the auxiliary suckers are almost in line with the anterior ones; the posterior suckers are on the same plane (ventral) as the others.

Legs I and II are respectively 40 and 30% of the length of the idiosoma; the ventral setae of the femur are shorter than the femur and genu together; arising from the tarsi are 3 fairly large, lanceolate setae, 1 dorsal and 2 ventral, of which the external is displaced on to the lateral surface of the tarsus; delta is vestigial and replaced by a rounded pore. Legs III are 18% of the idiosoma, their tarsi exceedingly short, much shorter than ambulacra III and armed with a long digitiform process and 4 lanceolate setae (2 dorsal, and 2 ventral). Legs IV are very short (13% of the length of the body), each with a wide triangular tarsus; the digitiform process is almost cylindrical, widely rounded at the end; beside it arises a scale-like projection drawn out at the end into a process, the whole structure being 1.5 times longer than the digitiform process; the seta arising from its base is fairly long and thin; the apical macroseta is 3 times longer than legs IV and 1.75 times longer than the subapical seta. Length 250 to 270μ, width 144 to 150μ.

Distribution. Germany, the valley of Main, in the neighbourhood of Nuremberg; Armenia (near Ehlara); the N.W. Uzbekistan (the Aktash Mountain, near Tashkent). The host is found (according to Kostev) in N. Africa, W. Europe. the mountains of Central Europe, the Crimea, the Steppes around Stalingrad, the far-eastern Caucasus, C. Asia, S. Kazahstan and Altai.

Ecology. It lives in the nests of the wasp Odynerus (Lionotus) floricola Sausse (O. delphinalis Gir.). The adult Ensliniella sticks to the larva of the wasp (particularly on the lower surface of the first thoracic segment), probably feeding on its secretions and not harming it in any way. The mites start breeding just before the host pupates and the larvae and protonymphs live on the pupae. Hypopi are formed just as the host emerges and these crawl on to the host and occupy a special cavity beneath the overhanging edge of the first tergite, which is peculiar to Lionotus; some, however, distribute themselves on the posterior slope of the thorax. One wasp may carry several hundred hypopi. The ultimate fate of the hypopi is not known, but most likely they leave the wasp at the moment of egg-laying and they may migrate from the ♂ to the ♀ at the time of copulation. This occurs in the case of the triunguline larva of meloid beetles and in the Strepsiptera, thus infecting a new nest in which further development can take place. It has not been established whether Ensliniella parasitica has 1 generation per year, like the host, or whether several generations have time to develop in 1 nest.

2. Ensliniella kostylevi sp.n. (Figs. 400, 401, 441.)

This is known only in the hypopial stage. It closely resembles that of E. parasitica, but the eyes are wider apart and the hysterosomal shield is broader and does not narrow so sharply towards the posterior end. The longitudinal sclerotised apodeme is short and the arists are long and capilliform. The ventrum is very long and extends posteriorly

almost as far as the genital slit; the thickened edges of the posterior part of the ventral shield have an angular outline, but they fuse in the mid-line of the body and are not connected with the incomplete sclerotised framework encircling the anterior suckers. The external suckers are almost on the same line as the central ones, the auxiliary considerably posterior to the anterior ones; the posterior suckers are almost vertical (when viewed from above, they are only seen in profile).

The ventral setae of femora I and II are longer than the combined length of femur and genu. Sensilla delta is absent and eta slightly thinner. Legs III are rather longer (21% of the idiosoma), the tarsi not so short, but longer than the ambulacrum; the digitiform spine is absent and there are only 3 lanceolate setae (1 dorsal, 2 ventral). Legs IV are the same length as those of E. parasitica; the apical macroseta is twice as long as legs III and longer than the subapical seta. Length 250 to 280μ, width 145 to 160μ.

Distribution. It has only been found in White Russia (Belovej), Vitzthum 1924, and in the Crimea (Karadag). It lives in the nests of Odynerus (Lionotus) rossii Lep.; this is found in West and Central Europe, the Crimea, and far Caucasus (Zakavkazie).

6. Genus Nanacarus Ouds.

Oudemans, 1903, Tijdschr. Entomol., XLVI, 8. Froweinia, Oudemans, 1903, Entomol. Ber., VI, 183 (nymph); 1924, ibid. 231.

Type species: Nanacarus minutus Ouds.

This is an exceptionally small form (length 170 to 220μ). The chelicerae are normal in structure. The idiosoma is elongated, cylindrical, with an indistinct propodosomal shield; this may possibly be absent. Sc i are 4 times shorter than sc e; all the setae of the hysterosoma (except h e and p a) are very short (6 to 10% of the length of the idiosoma); d_2 are close together, d_3 are wider apart, and d_4

are nearer to the edge of the idiosoma than to the mid-line; sa i are the same distance apart as d_3 and are terminal; l a are equidistant between d_2 and d_3, whilst l p are almost on the same level as d_4; sa e and d_4 form a straight transverse row; sa i are very short and p a considerably longer than all the other setae of the idiosoma. The sternum is V-shaped; the epimeres are feeble, slightly arched and with indistinct apodemes; epimeres II are not distinct.

The legs are very short, but slender, the fourth pair more than usually displaced posteriorly; the dorsal setae of tibia I and II are fairly short; they are absent from tibiae III and IV; the middle apical seta of tarsi I to III is medium in length, but it is very long on tarsus IV; the apex of the tarsus is ventral, with one fairly large, strongly bent spine. The praetarsi are short stalked, and have no claws. Sexual dimorphism is sharply defined.

♂. Legs III and IV are noticeably thicker than in the ♀, and curved; the ventral apical spine of each tarsus is noticeably larger and shaped like a claw; the genital opening lies between the bases of legs IV, anterior to the anus.

♀. Legs III and IV are not thickened or bent; the apical spine of the tarsi is not enlarged; the genital opening is placed behind epimeres IV, near the anus; an epigynium is absent.

Hypopi have not been found. The nymphs differ from the adults (in addition to the usual characters) in having claws on the praetarsi and in lacking sc i, h i, d and l.

A monotypical genus.

1. Nanacarus minutus Ouds. (Figs. 395 to 399.)

Oudemans, 1902, Tijdschr. Ned. Dierk. Ver., (2), VII, 85, t. III, figs. 55 to 56 (hypopus); 1903, Tijdschr. Entomol. XLVI, 11, t.2, figs. 23 to 28 (Nanacarus; o, ♀).

White or pale in colour. The idiosoma is cylincrical, twice as long as wide; the lateral edges of the hysterosoma are almost straight, parallel to one another and without scapular protrusions; sc i are considerably posterior to sc e and short; the approximate lengths of the setae (expressed as a percentage of the length of the idiosoma in the ♀) are: v i 22, sc e 38, sc i 10, h e 17, d_2 6, d_3 8, d_4 6, l a 11, l p 8, sa i 5, sa e 6, p a 66 to 67%. The length of the legs in the ♀ is approximately 20 to 22% (I, II) and 18 to 19%; in spite of their shortness, the posterior legs extend beyond the posterior edge of the body; the sensory rod of tarsi I and II is short and spindle-shaped. Length of ♂ 172μ, of ♀ 220μ, width 102μ.

Distribution. It has only been found in the U.S.S.R. (Smolensk), Germany and Java.

Ecology. One nymph was found on a wood bee - Platynopoda tenuiscapa Wests., another on a bat - Eptesicus serotinus Schreb. from the surroundings of Bremen; a ♂ and 2 females were found by Oudemans in a test-tube with parasites from a rodent - Sorex araneus L. Volgin found N. minutus in grain.

7. Genus Vidia

Oudemans, 1905, Entomol. Ber., II, 21.

Type species: Vidia undulata Ouds. 1905.

This is only known as the hypopus. The eyes are absent or represented by a pair of feebly marked projections at the base of the rostrum, they are dorsal in position and devoid of a sclerotised retina. The gnathosoma is completely reduced or only represented by a pair of bristle-shaped arists. The dorsal shields are clearly patterned, the lines running transversely or slightly obliquely on the propodosoma and longitudinally on the hysterosoma; these lines sometimes anastomose with one

another, forming distinct narrow depressions, which may resemble scales. All, or almost all, the dorsal surface is covered by the hysterosomal shield (sometimes a narrow strip of membranous cuticle is left bare at the sides), which is not reflected on to the ventral surface.

Tarsi I and II have 2 or 3 leaf-shaped (lanceolate or sickle-shaped) setae; delta is absent; eta is somewhat thickened and may resemble a rod; legs IV are inserted on the body at a considerable distance from the posterior and lateral edges, so that only the distal part of the tarsi protrudes beyond its edges; trochanters III and IV are small. The tarsi have no digitiform or scale-like spines.

This genus contains 4 palearctic species, which are biologically connected with Hymenoptera living in wood, and 1 oriental one (V. squamata Ouds. 1909) found on a mouse - Rattus jordani Blyth (Semarang, Java).

Vidia

Hypopi

1(4) Tarsi I and II each with 3 lanceolate setae - 1 dorsal and 2 ventral; praetarsi I and II small and normal in structure. On bees (subgenus Vidia s.str.)

2(3) Sa i longer than p a. On Prosopis conformis Först. Italy.

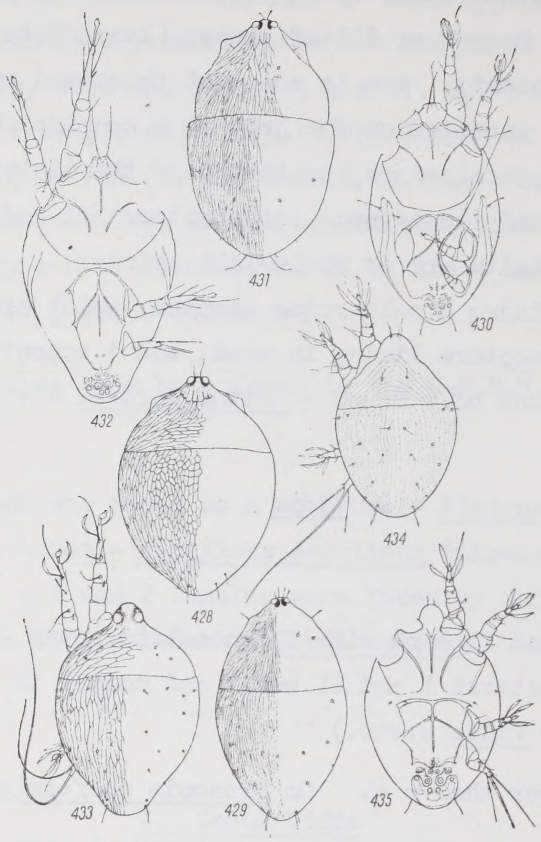
4. V. (s.str.) undulata Ouds.

3(2) Sa i shorter than p a. On many species belonging to the genus Megachile. Europe, Asia.

3. V. (s.str.) lineata Ouds.

4(1) Tarsi I and II each with 2 sickle-shaped setae, which are lateral in position; praetarsi I and II long, widened distally, to form a spoon-shaped sucker. On wasps of the genus Crabro (subgenus Crabrovidia subg.n.)

5(6) Idiosoma pear-shaped, becoming strongly narrowed posteriorly;



Figs.428 - 435. Hypopi of the genera Calvolia and Vidia.

Fig.428 - Calvolia reticulata, sp.n., dorsal surface. Fig.429 - C. fusiformis, sp.n., dorsal surface. Fig.430 - Ditto, ventral surface. Fig.431 - C. nataliae, sp.n., dorsal surface. Fig.432 - C. thraca Vtz., ventral surface. Fig.433 - Vidia (Crabrovidia) gussakovskii, sp.n., dorsal surface. Fig.434 - V. (s.str.) lineata Ouds., dorsal surface. Fig.435 - Ditto, ventral surface.

external sickle-shaped seta of tarsi I and II placed much nearer to the base of the dorso-apical seta than to that of the internal apical sickle-shaped seta; sensory club cylindrical; tibio-tarsus IV slender, longer than femur IV. U.S.S.R. (near Moscow, Crimea).

1. V. (C.) gussakovskii sp.n.

6(5) Idiosoma oval, gradually narrowing towards the posterior end; external sickle-shaped seta of tarsi I and II placed distinctly further from the base of the dorso-apical seta than from that of the internal apical sickle-shaped seta; sensory club swollen at its end; tibio-tarsus IV strong, much shorter than femur IV. U.S.S.R. Ukraine (Krasnograd), Crimea (Karadagh), Abkhasia, Ouzbekistan (Tashkent).

2. V. (C.) popovi sp.n.

1. Subgenus Crabrovidia subg.n.

Tarsi I and II very long and slender, with 2 sickle-shaped setae placed laterally, 1 external one (representing the external of the ventral pair displaced on to the lateral surface of the tarsus), and 1 internal one (internal apical); both these setae are strongly bent away from the tarsus and sharply curved, thus resembling similar setae found in the genus Caloglyphus. Praetarsi I and II large, with a considerably modified distal part, which is shaped like a large saucer-shaped sucker, capable of being bent perpendicular to the tarsus. Arists long and strong. Legs I and II long and slender.

To this subgenus belong nidicolous (nest-dwelling) species biologically connected with wasps of the genus Crabro.

1. Vidia (Crabrovidia) gussakovskii sp.n. (Figs. 433, 449 to 451.)

Hypopus. This is deeply coloured a dark chestnut brown. The body is pear-shaped, narrowing suddenly behind the base of legs IV to form a tongue-

shaped, slightly flattened caudal extremity; this closely resembles a similar formation in Calvolia thraca Vtz. The propodosomal shield is half the length of the hysterosoma, with a slightly angular rostrum; at its base is placed a pair of oval transparent protrusions. These are dorsal in position, feebly marked and not separated from the surrounding cuticle; an irregular mass of dark pigment is found beneath them, but no distinct retina. The sternal shield is outlined posteriorly and laterally by a continuous arched line, which in the middle touches epimeres III; epimeres IV are each feebly, but distinctly bent into an arc, these merge with one another in the mid-line and reach epimeres III. The sucking disc is circular, the anterior suckers much larger than the lateral or posterior ones, the auxiliary suckers are very large; the sclerotised regions are oval and wide and the posterior edge of the cushion of the sucking disc is clearly striated radially.

Legs I and II are long, slender, 47 to 40% of the body in length; the tarsi are very long and become regularly thinner from the base to the point of attachment of the anterior ventral setae; they then narrow sharply and widen again slightly towards the end; their length is more than 4 times the diameter at the base. The sensory rod is very long, becoming slightly thinner towards the end; the dorsal apical seta is very long, well-displaced from the end of the tarsus; the external sickle-shaped seta is considerably nearer to the dorsal apical seta than to the base of the internal (apical) sickle-shaped seta, it is also on the same level as the internal ventral seta. Legs III are fairly long (22% of the length of the body), the tarsi each bear a narrow, almost straight lanceolate seta and a very long apical "hair"; praetarsi III have each a long stalk with parallel sides and a round distal plate. Legs IV are 17 to 18% of the length of the body; the tibio-tarsus is slender, longer than femur IV, with a narrow, slightly widened distal part; the external macroseta is far removed from the apex of the tibio-tarsus and is very long. Length 195 to 265μ, width 120 to 160μ.

Distribution. It has been described from specimens from the Crimea (Kara-

dag) and from several places around Moscow. The hypopi were found on different species of the genus Crabro: C. fossorius L., C. impressus Sm., C. vagus F. and C. solenius L.

2. Vidia (Crabrovidia) popovi sp.n. (Figs. 452, 453.)

Hypopus. This closely resembles the preceding species and differs from it in the following particulars. The body is regularly egg-shaped, not elongated posteriorly into a tongue-like protrusion; correlated with its shortness of length, the hysterosoma is only 1.6 times longer than the propodosomal shield; the ocular projection is not clear; the posterior edge of the sternal shield is indistinctly outlined, separated from epimeres III by a considerable distance; epimeres IV are not connected to epimeres III by a short, straight longitudinal sclerite; the auxiliary suckers are slightly larger than the lateral ones and considerably smaller than the central.

The legs are similar in structure to those of V. gussakovskii, but slighfly shorter; the sensory rod is expanded distally; the external sickle-shaped seta is much nearer to the capilliform dorsal apical one than to the internal (apical) seta, also curved like a sickle, and considerably more anterior to the internal ventral. Tibio-tarsus IV is very short and is much shorter than femur IV; its distal portion is quite short and it gradually narrows towards its end. Length 195 to 230μ, width 150 to 180μ.

Distribution. It has been described from material found in the Ukraine (Krasnograd) of the Poltava region, Crimea (Karadag), Abahasia (Sinop) and Usbekistan (near Tashkent). I found the hypopus of this species on Crabro clypeatus L., C. alatus Pnz., C. wollmanni Kohl and C. impressus Sm.; on the last-named species it was sometimes associated with V. gussakovskii.

2. Subgenus Vidia s.str.

Tarsi I and II short, massive, with 3 wide, lanceolate setae, of which

2 are ventral and 1 dorsal, and placed next to the capilliform apical seta; praetarsi I to III are similar in structure, small and unmodified. The arists are fairly short. D_1 and d_2 are normal in position (at least in V. lineata). Legs I and II are short and fairly massive.

To this subgenus belong 2 species connected with bees of the genus Prosopis and Megachile, which nest in wood.

3. Vidia (s.str.) lineata Ouds. (Figs. 434, 435.)

Oudemans, 1917, Entomol. Ber., IV, 391.

Hypopus. This is a dull yellow in colour. The body is egg-shaped and variable in its proportions, the ratio of length to width varies within the limits of 1:2 to 1.5:1. The propodosomal shield is 1.5 to 1.8 times shorter than the hysterosoma; sc are arranged in a straight transverse row; the rostrum is widely rounded anteriorly. No eyes are present. The sternal shield is clearly defined laterally by straight epimerites II; the posterior edge of the shield (more accurately, of coxal fields II, since it is interrupted in the middle) is hardly marked and is separated from epimeres III; epimeres IV are straight, not separated from a common medial sclerite; the ventrum is well-developed, long and extends almost to the genital slit. The outline of the sucking disc is somewhat angular; the anterior suckers are the same size as the posteriors and laterals, the auxiliary suckers are noticeably larger; the lateral sclerotised regions are very large and bent into arcs which envelop the bases of the external suckers and extend posteriorly to the level of the posterior edge of the central region; the latter has an almost rectangular shape.

Legs I and II are fairly short (28 and 29% of the length of the idiosoma); the tarsi are short, gradually narrowing towards the apex, approximately twice as long as their diameter at the base. The sensory rod is fairly massive, straight and slightly thickened distally; the dorsal apical seta is placed at the same level as the internal ventral one, at a short distance from the end of the tarsus; the external ventral seta is

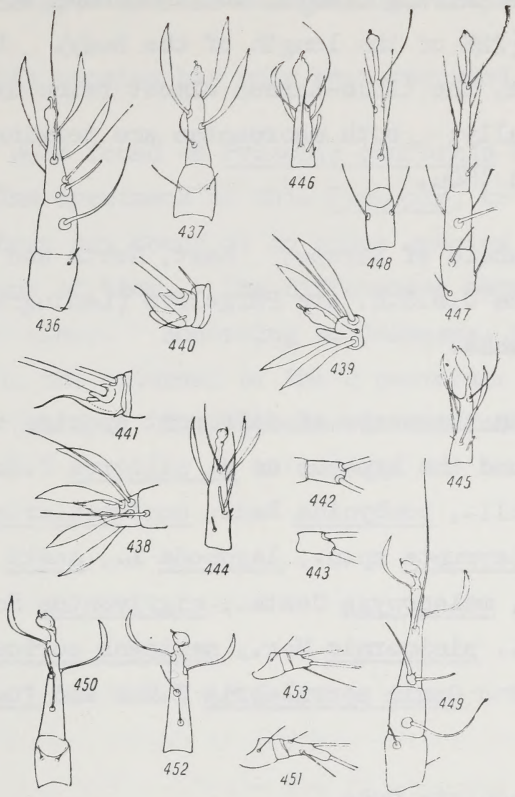


Fig.436 - 453. Details of the structure of hypopi of the Saproglyphidae

Fig.436 - Ensliniella parasitica Vtz., leg I, dorsal view. Fig.437 - E. parasitica Vtz., tibia and tarsus, ventral view. Fig.438 - E. parasitica Vtz., tarsus III, dorsal surface. Fig.439 - Ditto, ventral surface. Fig.440 - E. parasitica Vtz., end of leg IV, ventral surface. Fig.441 - E. kostylevi, sp.n., end of leg IV, ventral surface. Fig.442 - Calvolia reticulata, sp.n., tibio-tarsus IV. Fig.443 - C. elizabethae, sp.n., tibio-tarsus IV. Fig.444 - C. elliptica, sp.n., tarsus I, dorsal surface. Fig.445 - C. fusiformis, sp.n., tarsus I, dorsal view. Fig.446 - C. nataliae sp.n., tarsus I, dorsal view. Fig.447 - C. thraca Vtz., leg I, dorsal view. Fig.448 - Ditto, ventral surface. Fig.449 - Vidia (Crabrovidia) gussakovskii, sp.n., Leg I, dorsal view. Fig.450 - V. (Cr.) gussakovskii, sp.n., tibia and tarsus I, ventral view. Fig.451 - V. (Cr.) gussakovskii, sp.n., leg IV, ventral view. Fig.452 - V. (Cr.) popovi, sp.n., tarsus I, ventral surface. Fig.453 - V. (Cr.) popovi, sp.n., leg IV, ventral surface.

slightly proximal to the internal; the posterior seta is very short; eta is a thick, almost straight seta, not thickened at its base. Legs III are fairly long (22% of the length of the body). Legs IV are 18% of the body in length, the tibio-tarsus almost twice its diameter at the base and forked distally; both macrosetae are terminal. Length 210 to 265μ, width 140 to 180μ.

Distribution. The whole of Europe; East, North and Central Asia; its furthest limits in the U.S.S.R. are Pargolovo (Leningrad), Odessa, Voroshilov-Ussurisky, Kushka.

Ecology. It lives in the nests of different species of the genus Megachile; Oudemans found the hypopus on M. pilicrus F.Mor. I have found them on M. baleina Ckll., bombycina Rad., centuncularis L., cyprica Ckll., dohrandti F.Mor., interrupta sp.n., lagopoda L., maaki Rad., mandibularis F.Mor., maritima Ky., melanopyga Costa., nigriventris Schenck, octostigmata Nyl., orientalis Mor., picicornis Mor., sericans sericans Fonsc., sericans adlerbergi V. Popov and Osmia serrilabris F.Mor and fuciformis Latr.

4. Vidia (s.str.) undulata Ouds.

Oudemans, 1905, Entomol. Ber., II, 22.

Hypopus. I have not seen this species. According to Oudemans it is distinguished by having the dorsal surface completely covered by 2 shields, the propodosomal shield being covered with transverse striations, the abdominal with longitudinal; the lines are very thin and merge with one another, so that they appear wavy. There are 4 propodosomal setae, 2 scapulars, 4 pairs of submarginals and 4 marginal setae, which are posterior in position. All these setae are very small and difficult to see; in addition, there is 1 pair of longer caudal setae ("sleepharen"). Tarsi I and II have dorsal lanceolate setae and 2 similar ventral ones. Tarsus III also has 2 lanceolate setae on dorsal and ventral surfaces. Tarsus IV has a ventral claw and terminates in 4 setae of varying lengths, the

longest being longer than the body. Length 210 to 250μ, width 165 to 200μ. The body is more or less hexagonal in shape.

Distribution. This species has only been recorded from Italy.

Ecology. Hypopi were found on Prosopis conformis Först. I have not been able to examine specimens of this Prosopis, as there are none in our museums. I have not found it on other species of Prosopis, although I have examined many of them. The differences between V. undulata and V. lineata are not clear. According to Oudemans, V. lineata differs from V. undulata in the external of the 2 posterior setae being longer than the internal (sa i). The opposite is the case for V. undulata.

3. Family Glycyphagidae.

Glycyphagidae (Berl.) Ouds. 1923 + Chortoglyphidae Ouds. 1923 + Carpoglyphidae Ouds. 1923 + Lentungulidae Ouds. 1923 + Ensliniellidae Vtz. 1931 (part).

In contrast to the 2 preceding families, whose members are similar in structure and habitat, those of the Glycyphagidae are exceptionally diverse. As a rule, the idiosoma is not divided; in those few cases where a division into propodosoma and hysterosoma is indicated, the suture is not deep and does not form a distinct division between the two parts of the body; also it is only clear on the dorsal side. The shape of the idiosoma is exceptionally variable, but it is almost always much wider than in the Saproglyphidae and Tyroglyphidae and often thicker (sometimes very considerably) in a dorso-ventral plane. In one series of species, there is a well-developed rostrum which may almost completely overhang the gnathosoma from above, and is sometimes separated from the rest of the idiosoma by a distinct transverse suture (many of the Labidophorinae). In the majority of forms, the cuticle is rough, densely covered with fine projections or with setae; it may be wrinkled or finely striated (Aëroglyphus), but is rarely smooth; when thickened, it may have a horny consistency (Chortoglyphus, Fusacarus and Gohieria). In many species it is strongly cuticularised, forming a hard exoskeleton which may be a dull brown in colour or tinged with red; sometimes only certain areas are strongly sclerotised, the surrounding cuticle being soft. The propodosomal shield is well-developed in only a few genera (Sennertia, Hericia, Hyadesia, Aëroglyphus); in Glycyphagus s.str. it forms a narrow longitudinal sclerite similar to the crista metopica of many Trombidiformes. An opisthosomal shield is almost always absent.

The number, structure and position of the setae on the dorsal surface of the idiosoma is very varied. Characteristically, members of this family bear 15 to 16 pairs of setae, which are divided into groups in the following way: 2 pairs of crista metopical setae, 2 pairs of scapulars, 2 to 3 pairs of humerals, 4 pairs of dorsals, 3 to 5 pairs of later-

als and 2 pairs of sacrals. The anterior crista metopica setae - v a - are present in all species, except certain of the Labidophorinae (Onycteroxenus, Xenocastor, where they are much reduced) and, as a rule, their bases are wide apart; v p (at the posterior end of the crista) are usually dorsal and far behind v a, but in some cases they are lateral (as in Tyrophagus), on a level with v a (Aëroglyphus, Chortoglyphus) or near them (Blomia); usually they are the same length as v a, sometimes longer; rarely are they absent. As usual the external and internal scapulars (sc e and sc i) form a transverse row and vary considerably in length. The humeral setae are usually lateral in position, the anterior ones (h a) being a considerable distance from the posterior (h p); in some species, a third pair - the subhumerals (sh) - is displaced anteriorly and comes to arise between h a and h p. The position of the dorsal setae, d_1 to d_4, is very varied. The laterals - l_1 to l_3 - are sometimes marginal, sometimes dorsal; l_3 may even be ventral in position. The sacrals (sa e and sa i) are usually terminal, but may be dorsal (Ctenoglyphus and others). Divergence from this plan usually results in the loss of separate pairs of setae or even of a whole group (e.g. Oryctoxenus has no sacrals), or in the appearance of auxiliary ones (5 pairs of laterals in the Ctenoglyphinae).

The structure of the coxal-sternal skeleton is very varied, but it usually differs from that of the Tyroglyphidae. Similarly, the structure of the legs and their chaetotaxy is variable, differing from that of neighbouring families. The claws are always stalked, i.e. they are inserted on the end of a membranous praetarsus and are not articulated to the end of the tarsus by connecting sclerites. The characteristic feature of the chaetotaxy of the legs is the tendency for the setae of the genu, tibia and other leg segments to be pectinate or to resemble combs; the modification of these setae into spines is practically never seen within the limits of the family.

Genital "suckers" are usually present in both sexes, seldom in the ♂ only (Cometacarus) or in the ♀ (Sennertia); normally they are shaped like rings and are only shaped like fingers in Carpoglyphus; sometimes they

are rudimentary (Blomia thori) or absent.

♂. Anal and tarsal copulatory suckers are absent in all representatives of the family, except Chortoglyphus, where they differ sharply in structure from the copulatory suckers of the Tyroglyphidae. The position of the genital opening and structure of the copulatory apparatus is very varied; in many species there is an epiandrium. Only 1 pair of anal microsetae is present, anterior to the anal slit (in cases where they have been converted into suckers, as in Chortoglyphus, they are absent altogether). As a rule, there are 3 pairs of postanal setae.

♀. The position and structure of the genital opening (oviduct) is very variable; an epigynium is usually present and, in most of the Labidophorinae, there is also a circumgenital ring; between the genital valves there is a characteristic crescentic indentation. The copulatory opening is often at the end of a conspicuous copulatory tube, which may be quite long. The anal slit varies in position. The anal complex of setae can be divided into 2 groups: the preanal complex, represented by 2 pairs of microsetae (pr a), forming a transverse row in front of the anus, and a postanal pair (p a) consisting of 3 (in Aëroglyphus 4) pairs of longer setae, placed in the form of a triangle along the sides of the posterior end of the anus; sometimes they are marginal and encircle the posterior edge of the idiosoma (Ctenoglyphus).

Secondary sexual characters are very varied in the two sexes; such differences are most clearly seen in many Labidophorinae and Ctenoglyphinae, where the males are completely different from the females; in other groups, these differences may be slight and in the various subfamilies and genera related to different characters, ranging from size and general shape of the idiosoma to fine details of chaetotaxy. Dimorphism in the ♂ has never been observed.

Nymphal stages sometimes differ from adults. The reduction of the "bruststiele" is characteristic of the larvae; these rods have no apical "dome" and are shaped like fleshy protrusions, very short tubes, or

ring-shaped formations. The vestigial genital suckers of proto- and telonymphs have, as a rule, the same circular shape as those of the adult, but they have in addition an encircling oval (perhaps corresponding to the crescentic indentation of the genital valves of the ♀). In Chortoglyphus and evidently in Blomia as well, the nymphal genital suckers are better developed than those of the adult, which are reduced. The hypopial stages vary so much in structure that it is difficult to describe them in such a way as could be applied to the representatives of all families.

The family Glycyphagidae is here used to include the above-mentioned 5 families of Oudemans' and Vitzthum's scheme of classification. About 70 palearctic species are included in it (20 non-palearctic are also known at present), grouped into 26 genera; these fall fairly naturally into 7 more or less equal groups, which I refer to as subfamilies.

III. Family Glycyphagidae

Key to the Subfamilies

Males

1(2) Anal opening flanked by a pair of copulatory suckers shaped like funnels; tarsi IV with 2 pairs of tarsal suckers; genital opening placed between the bases of legs I, so that epimeres I are forced apart and the sternum is completely lacking.

1. Chortoglyphinae

2(1) Anal and tarsal suckers completely lacking; genital opening between the bases of legs III or more posterior in position; epimeres I united to form a rather long sternum.

3(4) Tarsi I and II (and sometimes III and IV) very short, ending in a strong spine shaped like a claw, at the base of which arises an extremely long, fine and flexible praetarsus. Marine species

living amongst seaweeds, dark in colour.

6. Carpoglyphinae

4(3) Tarsi I and II normal in structure, without a terminal spine shaped like a claw; praetarsus normal. Terrestrial species.

5(6) Cuticle very finely and densely striated; nearly all the dorsal surface of the idiosoma is covered by a clearly outlined area covered with small triangular spines (squamoids); dorsal setae long, becoming gradually shorter towards the posterior end, so that d_1 are much longer than those behind them; v p lateral in position, arising at the same level as v a. On bees of the genus Xylocopa and bumble bees.

3. Aëroglyphinae

6(5) Cuticle different in structure; d_3 and d_4 longer than d_1 and d_2, or else represented by microsetae or short spines; v p much more posterior than v a; when on a level with the latter (genus Blomia), very close to them. The adults are never found on living insects.

7(10) Legs III and IV more or less strongly modified.

8(9) Legs III much longer and thinner than legs IV, not curved; gnathosoma very narrow, idiosoma flattened, rhomboidal; claws fairly strong, curved. Living in sap oozing from the trunk of trees.

6. Carpoglyphinae

9(8) Legs III much shorter than legs IV, of the same shape, but more or less strongly curved and flattened, with the tarsi obliquely truncate at their ends; claws very small; gnathosoma fairly wide, often hidden by a well-developed rostrum; idiosoma a different shape. Living in mammals' nests (Rodents and Insectivores) and in lofts.

5. Labidophorinae

10(7) Legs III and IV normal in structure.

11(12) Epimeres II united at their ends with the sternum, forming with it a W-shape; epimeres III and IV free; gnathosoma very thin and mobile; cuticle smooth; all the setae of the dorsal surface of the idiosoma smooth, very short, except sa e and one of the postanal pairs, which are represented by long flexible macrosetae.

6. Carpoglyphinae

12(11) Coxal-sternal skeleton different; proportions of gnathosoma normal; cuticle very finely granular, sometimes only wrinkled; setae of the dorsal surface of the idiosoma long, more or less pectinate, rarely very short, then resembling spines and with a cuticle covered with triangular scales.

13(14) Five pairs of lateral setae; all the postanals arise from the edge of the idiosoma, so that the dorsal and lateral surface bears 17 to 20 pairs of strong setae; if there are less, they are wide and resemble leaves; coxal fields I to III sclerotised, closed, forming 2 oblique rows (diverging posteriorly) of coxal shields very close to one another; penis usually very long. Small species, living in hay and the dust of cellars.

4. Ctenoglyphinae.

14(13) Three pairs of lateral setae; the postanals are remote from the edge of the idiosoma, which bears, at most, 14 pairs of setae; coxal-sternal skeleton a different shape.

15(18) Tarsi very fine, curved; claws very small, hardly visible; all the dorsal and lateral setae of the idiosoma (except sometimes d_2) are very long, densely pectinate or ciliate, flexible. Species usually synantropic.

16(17) V p well posterior to v a; gnathosoma of normal dimensions; idiosoma elliptical, with rather curved lateral edges;

epimeres II oblique, united at their internal ends with epimeres III; distal extremity of genu I with 2 dorsal sensillae.

2. Glycyphaginae

17(16) V p arising quite close to v a, forming with them a straight or angled row; gnathosoma very strong; idiosoma oval in shape; epimerites II free, transverse; distal extremity of genu I with only 1 dorsal sensilla.

1. Chortoglyphinae

18(15) Tarsi less thin, not curved; claws large, setae of the dorsal and lateral surfaces of the idiosoma fairly short or very short (one pair between them - sa e - are long, but always smooth), rarely pectinate or almost smooth. Living in the nests of various Hymenoptera.

7. Chaetodactylinae

Females

1(2) Cuticle very finely and densely striated; almost all the dorsal surface of the idiosoma is occupied by a distinctly outlined area covered with tiny cuticular projections (squamoids); dorsal setae fairly long, becoming shorter towards the posterior end of the body, so that d_1 are much longer than those that follow them; v p lateral in position, and on the same level as v a; 4 pairs of postanal setae; on bees of the genus Xylocopa and bumble bees.

3. Aëroglyphinae

2(1) Structure of cuticle different; d_3 and d_4 longer than d_1 and d_2 or equal in length; v p occupies a different position; if marginal in position and at the same level as v a, the cuticle is absolutely smooth and stiff and all the setae arising from the dorsal surface resemble fine microsetae. The adults are never found on living insects.

3(4) Peripheral setae of the idiosoma are widely pectinate, bipectinate, or like leaves, 13 to 21 pairs, as the humerals and postanals are strictly marginal in position, and there are 5 pairs of lateral setae (if less, they resemble leaves); generally the setae form a fringe encircling the idiosoma; cuticle thickly wrinkled or covered with tall cylindrical tubercles, whose apices are subdivided, the surface is rarely rough. Living principally amidst the hay and dust of cellars.

4. Ctenoglyphinae

4(1) All the setae of the idiosoma have a different shape; 3 pairs of lateral setae; the postanals are ventral in position, at a distance from the posterior edge of the idiosoma; the cuticle has a different structure.

5(8) All the setae of the dorsal and lateral surfaces of the idiosoma long (often extremely long) and flexible, densely or finely pectinate; idiosoma strongly convex; cuticle very delicate, colourless, very finely granulate; tarsi very long and fine and bent; setae of genua and tibiae (except for the single apical one) densely pectinate.

6(7) V p well posterior in position to v a; genital opening oblong, almost entirely covered by well-developed genital folds, and provided with an epigynium; copulatory tube short and straight; genu I with 2 apical sensillae.

2. Glycyphaginae

7(6) V p placed near to v a, forming together a straight or angled line; gnathosoma strongly developed; genital opening very large, widely open (thanks to reduction of the genital folds), without epigynium; copulatory tube long, very thin, strongly curved; genu I with only 1 apical sensilla.

1. Chortoglyphinae

8(5) All the setae of the dorsal surface of the hysterosoma relatively

short, smooth or finely and sparsely pectinate, in the latter case they are rather stiff; shape of idiosoma and structure of cuticle variable; tarsi stouter (not bent).

9(10) Tarsi I and II very short, ending in a very strong claw, at the base of which arises a very long, fine and flexible praetarsus. Marine species, dark in colour.

6. Carpoglyphinae

10(9) Tarsi I and II normal, without a strong claw and with a normal praetarsus. Terrestrial species.

11(16) Cuticle absolutely smooth, stiff, somewhat sclerotised.

12(15) Cuticle colourless, translucent; legs thin, normal in structure.

13(14) Epimeres II free; those of the first pair joined together and forming a well-sclerotised transverse fold, whose posterior edge is produced to form a very short, free sternum; no epigynium; chelicerae very strong; all the setae of the idiosoma are represented by fine microsetae, which are difficult to see; setae arising from the legs are pectinate.

1. Chortoglyphinae

14(13) Sternum and epimeres II joined at their ends to form a strong epigynium; gnathosoma very narrow and mobile; sa e and one of the pairs of postanal setae very long, capilliform; all the remaining setae of the idiosoma short, stiff and terminally blunted; setae arising from the legs smooth and needle-shaped.

6. Carpoglyphinae

15(12) Cuticle strongly pigmented, brownish; legs I and II strongly compressed laterally or ornamented with longitudinal keels.

5. Labidophorinae

16(11) Cuticle granular, spiny or with some other distinct pattern, variable in consistency.

17(18) Gnathosoma very narrow; all the setae of the idiosoma smooth, stiff; epigynium arched, free. Living in the sap oozing from tree trunks.

6. Carpoglyphinae

18(17) Gnathosoma strong; epigynium shaped otherwise, usually united to the sternum. Living in mammal nests or with Hymenoptera.

19(20) Claws very small; none of the setae arising from the posterior end of the body are longer than the others. Living in Rodent and Insectivore nests.

5. Labidophorinae

20(19) Claws large, often very large and hooked; sa e very long, smooth, much longer than the other setae of the hysterosoma. Living in the nests of various bees.

7. Chaetodactylinae

1. Subfamily Chortoglyphinae

The gnathosoma is freely movable, 30 to 35% of the idiosoma in length; the chelicerae are exceptionally strong and massive, with chelae which are thick and sharply rounded terminally; the base of each chelicera is widened horizontally. The idiosoma is egg-shaped and very convex, but not divided into propodosoma and hysterosoma; there is no rostrum. The cuticle is colourless, smooth, rigid or of a membranous consistency, it is very finely covered with raised dots. The setae arising from the dorsal surface of the idiosoma are fine smooth microsetae (Chortoglyphus) or are finely pectinate like those of Glycyphagus (Blomia), in the latter case, d_2 are smooth microsetae; both pairs of crista setae (v a and v p) are at the anterior edges of the idiosoma, forming a transverse row or a trapezoid figure; three pairs of humeral setae (h a, h p and sh) and 3 pairs of laterals (l_1 to l_3) are present; the pseudostigmatic organ is simple

bristle or rod-shaped. The genital suckers are absent or strongly reduced. The coxal-sternal skeleton is feebly-developed and the epimera have no plate-like apodemes; epimeres I are fused at their ends along the mid-line, forming a Y- or ⌣-shaped figure, sometimes free and sometimes slightly modified (as in the ♂ of Chortoglyphus); epimerites II are completely free, placed transversely or obliquely; epimeres III and IV are completely reduced; epimerites IV absent.

The legs are very thin and adapted for running, with very long tarsi; the setae of the trochanter and femur are very thin and pectinate, whilst the basal setae of the genu and ventral ones of the tibia resemble combs (in the genus Chortoglyphus) or are thickly pectinate, like those of Glycyphagus (the genus Blomia). The apex of genu I has only 1 sensory organ, which is a cylindrical or strongly thickened sensory rod (the second seta is absent in this subfamily, but present in all the others); the apical setae of tibia I and II are exceptionally long, and those of tibiae III and IV are longer than usual; the sensory rod of the tarsi is very thin and long, whilst gamma, and sometimes beta as well, are absent; in the medial region of tarsi I to IV, there are 4 setae (2 lateral and 2 ventral), which may be pectinate, smooth or resemble spines; the apical spines of the tarsi are sometimes strongly developed. The praetarsi are long, well-developed and terminate in small claws. Secondary sexual characters are very insignificant.

♂. The structure of copulatory suckers and associated structures is given in the descriptions of the genera.

♀. These have an exceptionally wide, gaping genital opening placed between the bases of legs III and IV; the genital folds are greatly reduced and an epigynium is absent; in the genus Blomia, a long copulatory tube is developed, which is completely absent in Chortoglyphus; the arrangement of setae in the anal complex is also quite different in both genera.

The larva (which is only known in Chortoglyphus) has reduced "brust-stiele"; in the proto- and telonymph, the genital suckers are better

developed than in the adult. As far as is known, none of the representatives of this group form a hypopus.

In my opinion, 2 genera belong to this subfamily: Chortoglyphus Berl. with 2 species, and Blomia Ouds. with 3 or 4. I am including them in 1 subfamily, in spite of the sharp differences in the structure of the copulatory apparatus of the males (in Blomia the copulatory apparatus is typical for the family, whilst Chortoglyphus is atypical in having anal and tarsal copulatory suckers) and in the difference in arrangement, length and structure of the setae of the idiosoma; as a matter of fact, their systematic affinities are very great and one cannot attribute much taxonomic importance to these characters; the presence or absence of tarsal suckers are linked functionally together (and therefore can be regarded as one character), whilst an analogous variation in structure and length of setae is met with in many other natural groups, e.g. in the Glycyphagidae, amongst the Labidophorinae.

The representatives of the subfamily Chortoglyphinae are almost exclusively synantropic, living in grain, flour and other plant products in stores and granaries, and in the dust of houses; they are all slow-moving forms with a low biotic potential.

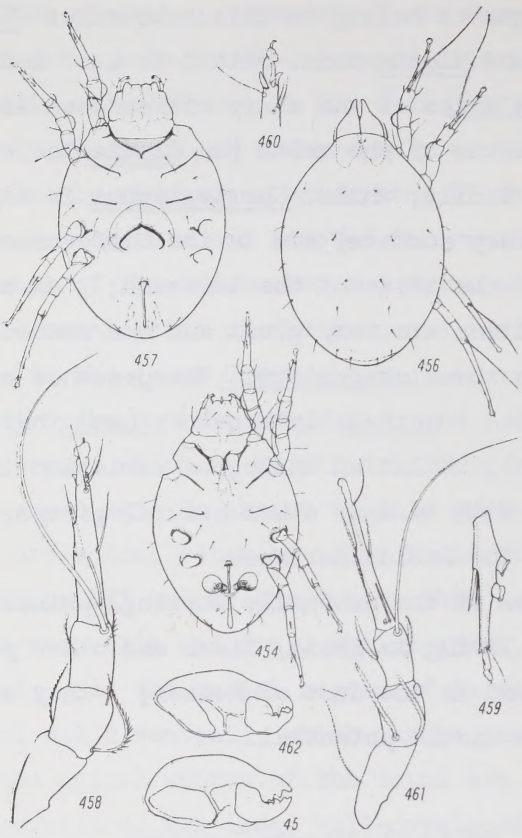
1. Subfamily Chortoglyphinae

Key to the genera

1(2) All the setae of the dorsal surface of the idiosoma very short, smooth, scarcely visible; cuticle smooth, stiff; setae of tibiae and genua I and II pectinate, one of those arising from the ventral surface of the tarsus is like a spine; ♂ with tarsal and anal suckers, the genital opening is strongly displaced anteriorly and situated between the ends of epimeres I, which are forced apart. ♀ without copulatory tube.

1. Chortoglyphus Berl.

1 palearctic species, C. arcuatus Tr. England, France, Italy, U.S.S.R. (Moscow, near Ivanovo and Smolensk, Barnaoul).



Figs.454 - 462

Fig.454 - Chortoglyphus arcuatus Tr., ♂ , ventral surface. Fig.455 - Ch. arcuatus Tr., ♂ , internal view of chelicera. Fig.456 - Ch. arcuatus Tr., ♀, dorsal surface. Fig.457- Ditto, ventral surface. Fig.458 - Ch. arcuatus Tr., leg I, ♀ . Fig. 459 - Ch. arcuatus Tr., tarsus IV, ♂ , Fig.460 - Ch. arcuatus Tr., end of tarsus I, ventral view. Fig.461 - Blomia thori A.Z., leg I, ♀. Fig.462 - B. thori A.Z. chelicera.

2(1) All the setae of the dorsal surface of the idiosoma (except d_2) long, fairly strong, densely pectinate; cuticle of a membranous consistency, very finely granular; setae of tarsi, tibiae and genua thick, densely pectinate; ♂ without anal and tarsal copulatory suckers, with a genital opening between the bases of legs III and IV; ♀ with a very long fine copulatory tube.

2. Blomia Ouds.

1. Genus Chortoglyphus Berl.

Berlese, 1884, XIV, No. 4; LXXXVIII, No. 9; Kramer, 1899, 137.

Type species: Tyroglyphus arcuatus Troupeau 1879.

The cuticle is fairly strongly thickened, of a hard consistency and completely smooth. All the setae of the idiosoma are thin, short and difficult to see; v p are longer than all the other seate arising from the dorsal surface of the idiosoma, clearly pectinate and placed on either side of the gnathosoma; h a and h p are on the same level as d_1, forming an arched transverse row with them; d_2 are nearer to d_3 than to d_1. The pseudostigmatic organ is a thin pectinate seta. Genital suckers are absent. The basal setae of genua I and II and the ventral setae of all the tibiae are pectinate; the apical sensilla of genuaI and II is shaped like a rod; all the setae of the tarsi are smooth, one of the ventral ones being thickened to form a spine; the distal ends of the tarsi have 2 fairly large, bent lateral spines and 1 smaller ventral one.

♂. The genital opening is between legs I and II, so that epimeres I end freely and are wide apart anteriorly, they therefore take part in the formation of the genital folds, and the sternum is absent. The anal slit is immediately behind the base of legs IV, at a considerable distance from the posterior end of the body; on either side of it is a curious copulatory sucker, consisting of a circular sclerotised base, on which is inserted a wide membranous funnel; pr a are absent (possibly modified as the copu-

latory suckers); tarsi IV are slightly thickened in the middle and each bears a pair of cylindrical copulatory suckers.

♀. Epimeres I are fused in the mid-line of the body, forming a fairly wide transverse sclerotised plate, whose posterior edge is prolonged to form a short sternum; the posterior edges of the genital folds are curved; the folds themselves are strongly thickened and sclerotised, and they meet anteriorly at an obtuse angle; all pr a and p a are microsetae and form a longitudinal row (of 5 setae) on either side of the anal slit. The copulatory tube is completely absent.

The larvae have exceptionally small nipple-shaped "bruststiele"; in the protonymph and telonymph there are rudiments of genital suckers. Only 2 species have been described, C. arcuatus Troup. and the common N. American form - C. gracilipes Banks.

1. Chortoglyphus arcuatus Troupeau. (Figs. 56, 454 to 460.)

Troupeau, 1879, 113, figs. 27, 29 (Tyroglyphus). - nudus Berlese 1884, XIV, No. 4; Canestrini 1888a, 398, t. 341, fig. 4; - arcuatus Michael, 1903, t. 1 (Chortoglyphus).

When alive, this species is semi-transparent, a light greenish colour and very shiny; the legs and gnathosoma are pinkish. The idiosoma is fairly regularly egg-shaped, 1.4 to 1.5 times longer than its maximum width, which is slightly anterior to legs III. All the setae arising from the dorsal surface of the idiosoma are very thin microsetae, 3 to 5% of the length of the idiosoma; v p are noticeably thicker and about 8% in length; the ventral setae are noticeably longer than the dorsal.

The legs are very long and slender; the internal basal seta of genua I and II is much longer than the external, bent and coarsely pectinate; the external seta is straight; the ventral setae of the tibia are short; on legs I, they are on the same level at the end of the segment and lateral in position; on legs II the external seta is displaced

towards the middle of the ventral surface of the segment and is considerably more proximal than the internal one.

♂. The legs are approximately 50 to 54 (I), 47 to 50 (II, III), 51 to 54 (IV) % of the length of the idiosoma; tarsus IV is three-quarters the combined length of the 2 preceding segments and only 1.4 times longer than tibia IV; femur and genu IV are slightly curved; the internal ventral seta of tibia I is longer than the external one; both ventral setae of tarsus IV are almost at the same level. The penis is very large and resembles a sabre; the tarsal copulatory suckers are in the middle section of tarsus IV, at a distance from each other. Length 270 to 330μ, width 150 to 220μ.

♀. Legs I and III are relatively shorter than those of the ♂, whilst legs IV are much longer; in length they are 46 to 47 (I), 45 (II, III) and 56 to 57 (IV) % of the length of the idiosoma; tarsi IV are 1.5 times longer than the 2 preceding segments taken together and 2.5 times longer than tibia IV; femur and genu IV are straight; the internal ventral seta of tibia I is shorter than the external one; the internal setae of tarsi IV are smaller than those of the ♂, and are further away from each other. Length 350 to 450μ; width 170 to 250μ.

Distribution. France, Italy, England, U.S.S.R; in the U.S.S.R. it has only been found in or near Moscow and in some parts of Ivanovsk and the Smolensk district and in Barnaoul.

Ecology. It is mainly a granary species living in flour, wheat, rye, oats and in grass and vegetable seeds; it is also found in hay and old straw. It is sometimes found in the open in heaps of old straw. Owing to its low fertility and low ecological valency, C. arcuatus seldom causes noticeable damage to products which it inhabits. Its biology is almost unknown.

2. Genus Blomia Ouds.

Oudemans, 1928, Entomol. Ber., VII, 348; Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S. XLV; 266 to 267, 269 to 270.

Type species: Glycyphagus tjibodas Ouds. 1910.

A small and delicate species, resembling in its habits and general appearance the protonymph of the genus Glycyphagus; the cuticle is very thin and membranous, covered with very fine, raised dots. D_2 are thin, smooth microsetae, whilst the remaining setae of the dorsal surface of the idiosoma, sh and p_3 are medium in length or else long and thickly pectinate, resembling those found in the genus Glycyphagus, their relative lengths are also the same; thus, all the setae arising from the anterior half of the idiosoma are much shorter than those from the posterior half; sa i and sa e are the longest setae, sometimes reaching 80 to 100% of the length of the idiosoma; both pairs of verticals are grouped near the middle of the anterior edge of the idiosoma; h a are at the same level as sc, whilst h p are noticeably posterior to them; d_2 are nearer to d_1 than to d_3; the pseudostigmatic organ is a thick pectinate rod.

Epimeres I in both sexes are normal in structure and are joined in the mid-ventral line to form a short, V-shaped sternum. Genital "suckers" are absent or rudimentary. The basal setae of genua I and II, the ventral setae of all tibiae and all tarsal setae (except the apical and sensory ones) are thick and densely pectinate; the apical sensilla of genua I and II is very short and thick; at their distal ends, the tarsi have very fine, almost invisible spines.

♀. The genital opening is placed between the bases of legs IV and is covered by a pair of folds, which meet along their whole length; the anal slit is directly behind the genital and extends as far as the posterior edge of the body; anal copulatory suckers are absent and pr a are well-developed; tarsi IV are straight and devoid of suckers.

♀. The posterior edges of the genital folds are straight, not thickened, anteriorly they meet at an acute angle; the copulatory tube is exceptionally long, cylindrical and curved, its end pointing ventrally; its walls are densely sclerotised. Pr a and p a are normal in position. Immature stages are unknown.

To the genus Blomia belong 4 or 5 species, which are only synantropes; they are all very rare, occurring sporadically as isolated specimens or small colonies in houses and granaries.

Blomia Ouds.

1(2) Vertical setae arranged in a trapezoid shape; genital "suckers" absent in both sexes; internal ventral seta of tibiae I and II arising near the base of the joint, much more proximal than the external one; in the ♀ the posterior edge of the idiosoma has 2 distinct conical tubercles; copulatory tube very long. U.S.S.R. (Moscow).

3. B. kulagini A.Z.

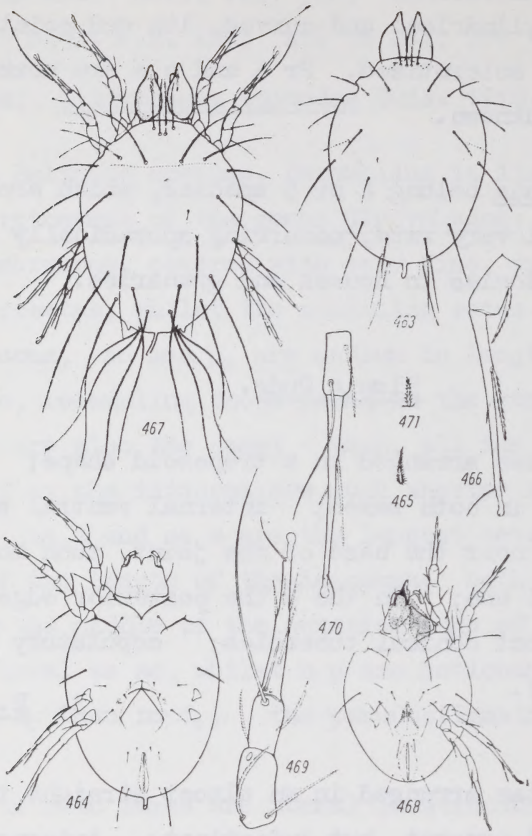
2(1) Vertical setae arranged in an almost straight transverse row; genital "suckers" present, but indistinct; internal ventral seta of tibiae I and II arising in the middle of the joint, almost at the same level as the external seta; ♀ without tubercles on the posterior edge of the idiosoma, with a shorter and more curved copulatory tube. U.S.S.R. (near Smolensk).

1. B. thori A.Z.

1. Blomia thori A.Z. (Figs. 461 to 466.)

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S., XLV, 267.

The vertical setae are arranged in a straight transverse row and are the same length; sc e are much shorter than sc i and h a are longer than



Figs.463 - 471

Fig.463 - Blomia thori A.Z., ♀, dorsal surface. Fig.464- Ditto, ventral surface. Fig.465 - B. thori A.Z., pseudostigmatic organ. Fig.466 - B. thori A.Z., tibia and tarsus IV, ♀, dorsal surface. Fig.467 - B. kulagini A.Z., ♀, dorsal surface. Fig.468 - B. kulagini, A.Z., ♂ , ventral surface. Fig.469 - B. kulagini A.Z., leg I, ♀. Fig.470 - B. kulagini A.Z., tibia and tarsus IV, ♀. Fig.471 - B. kulagini A.Z., pseudostigmatic organ.

h p; on the whole, the setae of the idiosoma are much shorter than in B. kulagini; the sternal and other setae of the ventral surface are normal in length. The genital suckers are rudimentary, but fairly conspicuous when magnified. The pectinate setae of the legs are fairly short and thick; the internal ventral seta of tibiae I and II is inserted slightly posterior to the middle of the segment, almost at the same level as the external one; the ventral seta of tarsus IV is much shorter than half the length of the tarsus; the apical sensilla of genua I and II is shaped like a blunt, protruding blob.

♂. The setae of the idiosoma are longer than in the ♀; d_4, sa e and sa i are particularly long, reaching a length of 70 to 85% of the length of the idiosoma; the approximate lengths of other setae (as a percentage of the length of the idiosoma) are: v 20 to 23, sc e 24, sc i 30 to 32, h a 33, h p 24, d_1 20, d_2 4, d_3 40, d_4 60, l_1 and l_2 34 to 36, l_3 approximately 60, pr a are less than one-third the length of the anal slit. The penis is widely rounded at its distal end. Length 305μ, width 220μ.

♀. All the setae of the idiosoma are shorter and their approximate lengths are: v 20 to 23, sc e 23, sc i 28, h a 25, h p 20, d_1 16, d_2 4, d_3 30, d_4 48, l_1 16, l_2 and l_3 30, sa e and sa i about 50 to 55% of the length of the idiosoma; the internal pr a are half the length of the external, the latter are less than half the length of the anal slit. Posteriorly the width of the genital opening is approximately equal to its length (measured from the posterior edge to the anterior connecting sclerite); the posterior edge of the body has no protrusions; the copulatory tube is noticeably bent ventrally, its length is considerably less than that of the genu. Length 320 to 375μ, width 245 to 280μ.

Distribution. It has only been reocrded from a few places in the Smolensk region, where it was found in flax seed.

2. Blomia tjibodas Ouds.

Oudemans, 1910, Entomol. Ber., III, 74; 1911, ibid., III, 169; 1914, ibid., IV, 102 to 103 (Glycyphagus); 1928, ibid., VII, 348 (Blomia).

♀. Length (including chelicerae) 362μ, width 168μ; almost a perfect ellipse in shape. The chelicerae are massive. Four setae arise in the crista region; in the middle of the dorsal surface are 2 small, thin setae; 8 setae arise from the posterior edge, of which the 2 longest are 285μ long. The pseudostigmatic seta is dorsal to trochanter I and resembles the thickly pectinate setae of genu I. On the distal end of genu I there arises dorsally a peculiar sensory organ, which has a rounded end. The ventro-proximal ends of the trochanter, femur and palpi each bear a crescentic seta, equal in length to the palpus. The genital opening is very large and is placed between legs III and IV (according to Oudemans).

Distribution. It was originally described from 1 badly preserved ♀ from Java (Tjibodas) and then another specimen was found by Oudemans in Holland (Arnhem); it is possible that these specimens belong to 2 different species, but the description is too superficial (generic characters are mentioned almost exclusively) and this question could not be decided without a detailed study of the author's preparations.

The above description of B. tjibodas has been taken from a paper on the Arnhem ♀, which was written in 1914; from this it can be seen that it differs from the 2 females of B. thori in its smaller size (B. thori is 410 to 465μ long, including the chelicerae) and the greater lengths of sa i and the copulatory tube; from B. kulagini it also differs in being smaller and in lacking conical protrusions on the posterior edge of the idiosoma.

3. Blomia kulagini A.Z. (Figs. 467 to 471.)

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S., XLV, 270.

The vertical setae are arranged like a trapezium, the internal ones noticeably posterior to the external; v i are much longer than v e; sc are all approximately the same length (sc i slightly shorter than sc e); h a are much shorter than h p; the setae of the dorsal surface are long and the sternal, genital and pr a are capilliform and longer than usual. Genital "suckers" are completely absent. The pectinate setae of the legs are long and thin; the internal ventral seta of tibiae I and II is placed right at the base of the segment, considerably more proximal than the external one; the internal seta of tarsus IV is almost equal to half the length of the tarsus; the apical sensilla of genua I and II is shaped like a thick conical spine.

♂. The lengths of the setae arising from the dorsal surface could not be established (in both existing specimens they dropped off during fixation); pr a are only half the length of the anal slit. The penis is extended anteriorly to form a short tube. Total length of the body is 305 to 325μ, the length of the idiosoma is 235 to 250μ, width 185 to 200μ.

♀. The approximate lengths of the setae of the idiosoma are: v i 27, v e 21, sc e 33, sc i 31, h a 23 to 24, h p 30, d_1 36, d_2 4, d_3 50, d_4 80, l_1 50, l_2 75, l_3 80, sa e 75, sa i 90% of the length of the idiosoma; both pairs of pr a are equal to half the length of the anal slit; the genital slit is much narrower than its length at the posterior edge; the posterior edge of the idiosoma has a pair of fairly large conical protrusions. The copulatory tube is the same length as genu I. Total length of the body is 400 to 415μ, the length of the idiosoma is 315 to 330μ, width 235 to 245μ.

Distribution. A small colony of this species was found in wheat stored in Moscow granaries.

2. Subfamily Glycyphaginae

The chelicerae are medium in length and fairly variable in structure. The idiosoma is very convex (almost globular), approximately elliptical in shape, not divided, without any sign of a transverse groove or a rostral protrusion; its lateral edges are slightly indented behind the barely discernible scapular protrusions; the posterior edge is widely rounded. The cuticle is colourless, of a delicate membranous consistency and covered with fine raised dots. The setae of the dorsal surface of the idiosoma are long and thickly pectinate; in life they project at right angles to the surface of the body; v p are much posterior to v a; there are 2 pairs of scapular setae and 3 pairs of laterals (l_1 to l_3); the pseudostigmatic spine is very strongly branched; the genital "suckers" are well-defined, seldom absent (♀ of Cometacarus).

The coxal-sternal skeleton is feebly developed, the epimeres having no plate-like apodemes; epimeres I unite to form a ⌣ shape in the mid-line of the body, epimeres II are free; epimerites II unite at their internal ends with the shortened epimeres III and IV and are obliquely placed; epimerites IV are absent. The legs are very thin and adapted for running, with very long slender curved tarsi; most of the leg setae are thickly pectinate; the apex of genu I has 2 sensory organs - one rod shaped, the other a seta; the sensory rod of tarsi I and II is medium in length, with 2 accessory sensillae at its sides; the apical setae of the tarsi are very small and barely discernible. The praetarsus is a narrow membranous lobe, with an extremely small claw. Secondary sexual differences are usually slight, but well-defined; they usually appear as modifications of some of the setae of legs I and II of the ♂.

♂. The genital opening is small, between legs III and IV, with a small epiandrium. The penis is small and tubular.

♀. The genital opening is between legs II and III; it is large, with well-developed folds, which meet in the mid-line over a long distance; a

small, often crescentic, epigynium is present, the copulatory tube is cylindrical and fairly wide.

The larva has small, but fairly well-defined "bruststiele". A migratory hypopus is never formed, but several species give rise to the dormant hypopus.

To this subfamily belong 2 genera; almost all its representatives are synantropes and are found in granaries; they are very active and quick in their movements.

2. Subfamily Glycyphaginae

Key to the genera

1(2) The longest setae of the idiosoma are not more than twice its length; v a are very close together, touching at their bases, v p are separated by a wide space; genital "suckers" small and distinct in both sexes; pseudostigmatic organ is a much branched spine.

3. Glycyphagus Hering

2(1) The longest setae of the idiosoma are more than 3 to 3.5 times longer than its length, forming together a long "train", like the tail of a comet; v a separated by a wide space, v p nearly touch at their bases; genital "suckers" fairly large in the ♂, absent in the ♀; pseudostigmatic organ is a much branched bifurcate spine.

4. Cometacarus A.Z.

3. Genus Glycyphagus Hering

Hering, 1838, Nov. Act. Acad. Leop., XVIII, 2: 619; Canestrini, 1888, 6; 1888a, 355; Berlese, 1897, 106; 1898, LXXXIX, No. 1; Kramer, 1839, 144; Michael, 1901, 226 (partim). - Glycyphagus + Lepidoglyphus; Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S. 45, Livr. 4, 263 to 270.

Type species: Glycyphagus prunorum Hering 1838.

The chelicerae are normal in structure, fairly short and massive, the cutting edges of both shears are strongly toothed over their entire lengths. The setae of the idiosoma are cylindrical and completely pectinate, very long, but not longer than 1.5 to twice the length of the body. V a are near together, but slightly removed from the anterior edge of the idiosoma; v p and sc are wide apart; two pairs of humerals (h a and sh) are present; d_2 varies in position, also the length of p a. The pseudostigmatic organ has 1 trunk. The external ends of epimerites II are free and they slant externally and anteriorly; internally they are joined with epimerites IV to form a right angle, and they have no hook-shaped protrusion. The genital "suckers" are well-developed in both sexes. The tarsi are armed with toothed setae of medium length or else are ensheathed in a hairy scale (representing the modified ventral seta of the tarsus); the sensory rod of tarsi I and II is thin and cylindrical and the apical seta of tibia III is approximately the same length as that of tibia I or II.

♂. The genital opening is placed between the bases of legs III and a well-developed epiandrium is present.

♀. The genital folds are well-developed and meet for a long distance in the mid-line of the body; the epigynium is half-moon shaped or semicircular and lies in front of the anterior pair of genital setae.

The genus Glycyphagus contains 9 species which are abundant only in the Palearctic region. G. robustus Banks 1906 and G. obesus Banks 1906 from the U.S.A. belong, not only to other genera, but also to other subfamilies; (the systematic position of the Oriental G. latipes Berl. 1912 and G. geniculatus Vtz. 1919 is discussed below).

A great deal of confusion exists at the moment concerning the nomenclature and synonomy of the genus Glycyphagus; this is due to the difficulty of attributing the name given by Schrank 1781 to any of the recog-

nised species. G. cadaverum is used by other authors for the species which is here called G. (Lepidoglyphus) destructor Schrank, and sometimes also for G. privatus, which was described by Oudemans in detail. In this work I am using the nomenclature devised by Oudemans (1913) in his paper: Glycyphagus groepen (Ent. Ber. III, 328).

Glycyphagus Her.

1(10) Tarsi ensheathed by a pectinate scale, which makes them appear hairy; crista metopica absent; ventral seta of femur I thin and smooth. (Subgenus Lepidoglyphus A.Z.).

2(5) Basal seta of genua III modified to form a large oval or lanceolate scale, which is densely pectinate; distal edge of the tibia expanded into a blade, forming a large cone; pectinate setae of the idiosoma and legs coarser and more strongly feathered.

3(4) A larger species: ♂ 450 to 560µ, ♀ 600 to 800µ; scale arising from genu III oval in shape, almost twice as long as its maximum width; the pectinations at its edge are almost the same size as those which cover its surface. England, U.S.S.R. (Leningrad, Moscow, Ivanov region, Bashkiria).

4. G. (L.) michaeli Ouds.

4(3) A smaller species: ♂ 350 to 400µ (♀ unknown); scale arising from genu III narrow, lanceolate, 6 times longer than its maximum width; the pectinations which border it form a long fringe. Germany, U.S.S.R. (Smolensk).

5. G. (L.) burchanensis Ouds.

5(2) Basal seta of genu III not enlarged, similar in structure to the other setae on the legs; tibiae without blade-like extensions; pectinate setae of idiosoma thin.

6(7) Pectinate setae of genu and tibia I very wide; apical seta of genu I very short, almost the same length as the sensory club beside

it; in the ♂ the sensory club of genu II is strongly enlarged and resembles a strong spine, the same length as the genu; in the ♀ the genital opening is much longer than the distance between its posterior edge and the anal opening; posterior pair of genital setae is at the same level as its posterior edge. Germany, U.S.S.R. (Ivanov region).

3. G. (L.) fustifer Ouds.

7(6) Pectinate setae of tibiae and genua I and II narrow; apical seta of genu I 4 to 6 times longer than the sensory club beside it; sensory club of genu II of normal size, very small in both sexes; the genital opening of the ♀ is equal to the distance between its posterior edge and the anal opening; posterior pair of genital setae placed much posterior to the posterior edge of the genital opening.

8(9) Very small species: ♂ 225μ; pectinate setae of the idiosoma extremely long; d_3, d_4 and sa e twice, l_3 1.5 times longer than the idiosoma; in the ♂ pr a are equal to the length of the anal opening. Germany.

2. G. (L.) pilosus Ouds.

9(8) Average sized species: ♂ 350 to 430μ, ♀ 380 to 560μ; the longest of the pectinate setae of the idiosoma are shorter, not more than 1.5 times its length; in the ♂ pr a are shorter than half the length of the anus. Europe, palearctic Asia.

1. G. (L.) destructor (Schrk.) Ouds.

10(1) Tarsi without a pectinate scale, but with several fairly long barbed setae; crista metopica present; ventral setae of tibia I pectinate. (Subgenus Glycyphagus s.str.)

11(12) V a placed at the extreme end of the crista metopica, which extends posteriorly to the level of the sc i setae; d_2 normal in position, well anterior to d_3 and at the same level as l_1; sensory

club of genua I and II short, tapering towards its end. Holland, U.S.S.R. (near Ivanov, Smolensk and the Kalinin area, Bashkiria).

6. G. (s.str.) cadaverum (Schrk.) Ouds.

12(11) V a placed in the middle of the crista metopica, which only extends posteriorly to the level of v p; d_2 are displaced posteriorly, between d_3 and posterior to l_1; sensory club of genua I and II thin, long, cylindrical.

13(14) Ventral setae of tibiae III and IV arising from the distal edge of the segment; ventral setae of tarsi IV placed at an unequal distance from one another, but further from the distal one; the 2 ends of the crista metopica are pointed; in the ♂, tarsi I and II are strongly curved and the internal ventral seta of tibiae I and II is modified into a strong, triangular comb. England, Holland, Italy, Germany, U.S.S.R. (Moscow, Leningrad, Kiev, Bashkiria)

8. G. (s.str.) ornatus Kram.

14(13) Ventral setae of tibiae III and IV arising from the joint itself, far from its distal edge; ventral setae of tarsi IV equidistant from one another; anterior half of crista metopica wide, more feebly sclerotised than the posterior, which is narrow; tarsi I and II in the ♂ not curved, both ventral setae of tibiae I and II normal in structure. Europe and Palearctic region of Asia, the Arctic (Franz Joseph Land, Spitzberg, Greenland) and Tierra del Fuego.

7. G. (s.str.) domesticus Deg.

1. Subgenus Lepidoglyphus A.Z.

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. XLV, 264, 269.

A crista metopica is absent; d_2 are always considerably anterior to d_3 and on the same transverse line as l_1. The tarsi are enclosed

basally and laterally by a closely-fitting scale-like sheath (representing the modified posterior ventral setae of the tarsi), which is completely coated with fine pectinations, so that the tarsi appear to be thickly and finely pectinate (this scale often becomes detached in mounted preparations, so that the tarsi are bare); the remaining setae are displaced to the distal end of the joint and are very fine and smooth; the ventral seta of the femur is also smooth.

The larvae have very fine, non-sclerotised "bruststiele" which are shaped like warts. The resting hypopus has short, fully-developed legs, a fairly well-defined coxal-sternal skeleton and a distinct genital slit, with 2 pairs of rounded genital "suckers"; tarsus I has elongated claws and 2 terminal and hook-like thickened setae (more like spines, since they are not articulated); tarsus II and III both have a similar seta. The walls of the hypopial cuticle are covered with a raised reticulate pattern; they are almost transparent.

To this subgenus belong 5 species. G. geniculatus Vtz. 1919, which is common in tropical parts of the Old World, strongly resembles representatives of this subgenus, in having the tarsi enclosed in a sheath-like scale; it probably belongs, however, to a separate genus, as it differs from all other species in a number of important chaetotactic features, and also in having enlarged femora and genua, etc. Allied to G. geniculatus is G. latipes Berl. 1912, from Java, which has been inadequately described.

1. Glycyphagus (Lepidoglyphus) destructor (Schrk.) Ouds. (Figs. 22, 46 to 50, 52 to 55, 70 to 73, 75, 472 to 475.)

Schrank, 1781, Enum. Insect. Austr., No. 1057, t.2, fig. H (Acarus)(sec. Oudemans, 1905). - spinipes C.L. Koch, Dtsch. Crust., Myriop. Arachn., 33, No. 1 (Acarus). - spinipes Fumouze et Robin, 1867, Journ. Anat. Physiol., V, 33, 41, t. 23; Berlese, 1884, XIV, No. 2; Canestrini, 1888a, 381, t.27 fig. 1; Kramer, 1899, 147 (Glycyphagus). - cadaverum Oudemans, 1903, Tijdschr Ned. Dierk. Ver. (2), VIII, 209, t. VIII, figs. 16 to 25, et t. IX, figs.26 to 27 (Glycyphagus). - destructor Oudemans, 1905, Entomol. Ber., I, 238;

1913; ibid., III, 328; Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S., XLV, 265.
Hypopus: Mégnin, 1888, Ann. Soc. Entomol. Fr., I, 131.

V p are approximately the same distance apart as sc i, so that the bases of these 2 pairs of setae form a rectangular figure; the distance between v p and sc i is approximately 4 times less than the distance between the 2 sc i setae and 1.5 times less than that between v a and v p; the bases of all the long setae are small, without protrusions. The pectinate setae of the idiosoma are fairly thin and flexible, with short outgrowths; the longest setae, i.e. d_2, d_4, l_3 and sa e do not exceed the length of the idiosoma more than 1.4 to 1.5 times; d_1 and l_2 are usually much shorter than its length; p_1 are almost half the length of p_3, and p_2 are smooth microsetae. The pseudostigmatic organ has a very thin stem and much branched protrusions. The epimerites are much shorter than epimeres II.

The tibia and genu are normal in structure and are not produced into funnel-shaped extensions; the pectinate setae of the legs are fairly thin; the basal seta of genu III is not modified to form a scale; the ventral setae of tibiae III and IV are placed at a considerable distance from the distal ends of these joints; the apical seta of genu I is 5 to 6 times longer than the neighbouring sensory rod, but it does not extend beyond the apex of the joint.

♂. The epiandrium has a short, slightly widened or distally divided protrusion; the genital setae and pr a are very short (5 to 6 times shorter than sh); the sensory rod of genu II is not elongated. Length 330 to 340μ.

♀. The length of the genital opening is approximately equal to the distance between its posterior end and the anal slit; the epigynium is crescentic in shape; the posterior pair of genital setae is noticeably posterior to the end of the genital opening. Length 380 to 550μ.

Resting Hypopus. In living specimens, the body is oval, 1.3 to 1.4 times longer than its width, with an obtuse anterior edge and a fairly well-defined groove dividing it into propodosoma and hysterosoma; in mounted preparations it is spherical, without any sign of division; the apex of tibiae I to III bears dorsally a small conical projection; the basal hook-shaped seta of tarsus I is scarcely larger than the apical one, the latter being twice as long as the claw. Length 220 to 260μ (in preparations, up to 300μ).

Distribution. Europe and Palearctic Asia; perhaps it has been distributed into other countries in other products, but no data are available in the literature on this point.

Ecology. It is one of the most numerous and common species of granary mites, living in stores of grain, cereals, linseed, dry fruit and other plant materials; also in hay and straw; records of its occurrence in insect collections, dried mammal skins and other museum objects, also exist. It is more seldom found under field conditions, but it does occasionally occur in small numbers near human dwellings; there are isolated cases where it has been recorded in the wooded and mountainous Nareunsk region of Kirgiz, U.S.S.R., and in a hollow Capalla (Gallinago) solitaria Gr., but it is more common in fields, particularly in parts of the agricultural zone. The ecology of G. destructor has not been studied by anyone, but it has been shown experimentally that this species has a high resistance to acaricides (Smirnov and Polejaev 1936) and can live for a long time (Moniez 1899).

The nature and degree of damage caused by G. destructor has not been investigated. It is known that the mite is capable of gnawing small indentations in the surface of the seed, but it is incapable of penetrating into the embryo; it has been suggested that G. destructor lives mainly on debris present amongst the grain.

2. Glycyphagus (Lepidoglyphus) pilosus Ouds. (Fig. 513.)

Oudemans, 1906, Entomol. Ber., II, 122. - setosus Oudemans, 1904 (non C.L. Koch, 1841), Tijdschr. Entomol., XLVII, 127, t. 8, figs. 51 to 53.

This is very similar to the preceding species, but is much smaller in size, with longer setae arising from the idiosoma, d_3, d_4 and sa e are twice, l_3 1.5 times longer, d_1 and l_3 approximately equal to it in length; pr a and the posterior pair of genital setae are half the length of sh, whilst unlike those of G. destructor, p_1 are hardly longer than pr a. The pseudostigmatic organ has a thickened stem, split distally into 2 thick short branches, which have short, feebly divided lateral protrusions. The sternum and epiandrium are absent; epimeres II are almost 3 times longer than epimerites II. The structure and chaetotaxy of the legs resemble those of G. destructor. Length 255μ. ♀ unknown.

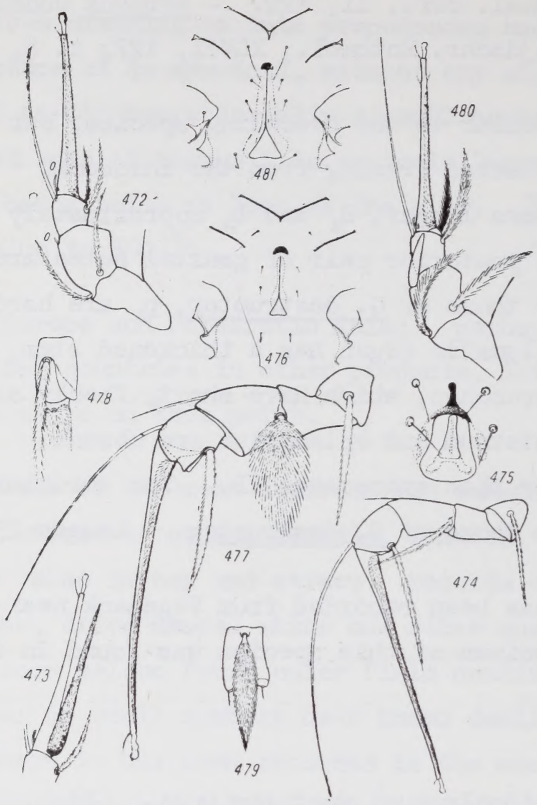
Distribution. It has been recorded from Vegesack near Bremen in Germany. The only specimen of this species was found in flour, with T. farinae.

3. Glycyphagus (Lepidoglyphus) fustifer Ouds. (Figs. 480, 481.)

Oudemans, 1903, Entomol. Ber., I, 103; 1904, Tijdschr. Entomol., XLVII, 129, t. 8, figs. 54 to 56.

V p are as wide apart as sc i, so that their bases form a rectangular figure; the distance between v p and sc i is 5 times smaller than that between the 2 sc i setae and 3 to 4 times less than the distance between v a and v p; the base of d_3 has no projection. The pectinate setae of the idiosoma are about the same length and thickness as in G. destructor; d_2 extend slightly beyond the posterior end of the body; all 3 pairs of p a are long and pectinate. The epimerites are the same length as epimeres II.

The tibiae and genua are normal in structure, without funnel-shaped widenings; the pectinate setae of the tibiae and genua I and II are



Figs.472 - 481.

Fig.472 - Glycyphagus (Lepidoglyphus) destructor Schrank, leg II, lateral view, ♂ . Fig.473 - Ditto, with the enveloping scale displaced. Fig.474 - Gl. (L.) destructor Schrank, leg III, ♀. Fig.475 - Gl. (L.) destructor Schrank, genital opening, ♂ . Fig.476 - Gl. (L.) michaeli Ouds., genital opening and setae of ♀. Fig.477 - Gl. (L.) michaeli Ouds., leg III, ♀. Fig.478 - Gl. (L.)michaeli Ouds., tibia and base of tarsus IV, ventral surface. Fig.479 - Gl. (L.) burchanensis Ouds., genu III with its leaf-shaped scale. Fig.480 - Gl. (L.) fustifer Ouds., leg II, ♂ . Fig.481 - Gl.(L.) fustifer Ouds., genital opening and setae of ♀.

much broader than in G. destructor; the basal seta of genu III is represented by a simple, pectinate seta, which is not modified; the ventral setae of tibiae III and IV are noticeably removed from the distal edge of the segment; the apical seta of genu I is extremely short, barely longer than the sensory rod, which is next to it.

♂. The epiandrium has a short linear protrusion; the genital and pr a setae are short; the sensory rod of genu II is enlarged to form a massive spine, equal in length to the genu itself. Length 300 to 400μ.

♀. The genital opening is very large, much longer than the distance separating it from the anal slit; the epigynium is semicircular; the posterior pair of genital setae are on the same level as the posterior edge of the genital opening; the sensory rod of genu II is normal in size. Length 415 to 480μ. The resting hypopus is unknown.

Distribution. It was described from 1 ♂ found near Bremen, Germany; in the U.S.S.R. it has only been found once in the Ivanovsk region (Bolotovo).

Ecology. This is a synantropic species, first found in an inhabited house and again in large numbers in the store of a collective farm on rye seed. It is possible that the form found in the U.S.S.R. is not identical with that from Bremen, as Oudemans describes and figures the hypertrophied sensory rod of genu II in the ♂ as an almost cylindrical structure with a rounded end, whereas in our specimens it is slightly wider in the basal quarter of its length and gradually narrows towards its somewhat pointed end; as there are no other detectable differences, I did not consider it to be a different subspecies.

4. Glycyphagus (Lepidoglyphus) michaeli Ouds. (Figs. 74, 75, 476 to

Oudemans, 1903, Entomol. Ber., I, 103. - spinipes Michael, 1888, Journ. Linn. Soc. Lond., XX, 285, t. 16, fig. 8 to 15; 1901, 245 to 250, t. VII

to VIII.

This is the largest species of the genus Glycyphagus. V p are nearer to each other than are sc i, so that the bases of these 2 pairs of setae together form a trapezium; the distance between v p and sc i is 3 times less than that between the sc i setae; the base of d_3 has no projection; the pectinate setae of the idiosoma are thick, the barbs arising from them being longer than in the destructor group; in length the longest setae are not more than 1.5 times the length of the idiosoma, and d_2 do not reach its posterior edge; p_2 are long, twice as long as p_1 and 6 to 8 times longer than the very short p_3. The epimerites are longer than epimeres II.

The distal edge of each tibia is expanded into a wide funnel shape; similarly, but to a lesser extent, the ends of the genu are also widened; the pectinate setae of the legs are very wide and thick; the basal seta of genu III is modified to form a very large, elongated oval scale, whose length is only twice as long as its maximum width; the whole of the external surface of this scale is densely covered with thin pectinations of almost the same length; the ventral setae of tibiae III and IV are placed in a special groove underlying the flattened edges of the segment; the apical seta of genu I is large (and extends far beyond the base of the tarsus); the adjacent sensory rod is very small and pointed at the end.

♂. The epiandrium is well-developed, with a linear protrusion; the genital setae and pr a are very short; the sensory rod of genu II is not hypertrophied. Length 450 to 460μ.

♀. The genital opening is 1.5 to twice as short as the distance between it and the anal slit, its posterior edge is on the same level as the anterior ends of epimeres III, i.e. much further forward than in other species; the epigynium is large and half-moon shaped; the posterior pair of genital setae is far behind the genital opening. Length 600 to 810μ.

The resting hypopus has a rounded non-segmented body, which is produced anteriorly into a narrow curved rostrum; the basal hook-shaped seta of tarsus I (according to Plate VIII, fig. 17 of Michael) is twice as long as the apical one, the latter is the same length as the claw. Length 240μ. The hypopial skin becomes noticeably narrower towards the posterior end and is almost fusiform; the opening flap is completely covered with a reticulate pattern.

Distribution. It has only been recorded from England and the U.S.S.R., from Moscow and its suburbs, Leningrad, near Kirjach (Ivanovsk region), in the Kirovsk region and from many parts of Bashkiria.

Ecology. It lives in hay and straw in old stooks, in hay lofts, stables and moist grain (oats and wheat), in barns and out of doors (e.g. in the wooded belt of Bashkiria and also near Leningrad); it is very common in granaries and may predominate over other species of Glycyphagus. It is more sensitive to desiccation than G. destructor and G. domesticus, evidently preferring moister surroundings; it is the most quick moving of all the granary mites.

5. Glycyphagus (Lepidoglyphus) burchanensis Ouds. (Fig. 479.)

Oudemans, 1903, Entomol. Ber., 1, 103; 1904, Tijdschr. Entomol., XLVII, 131, t. 9, figs. 57 to 60.

This is allied to G. michaeli, but is much smaller. The distance between v p and sc i is 4 times less than that between the sc i setae, and half the distance between v a and v p; the bases of all the pectinate setae are much larger, that of d_3 is prolonged into an elongated strut; the pectinate setae of the idiosoma are slightly longer and d_2 extend beyond the edge of the body. Epimerites II are half the length of epimeres II. The structure and chaetotaxy of the legs resemble those of previous species, but the funnel-shaped widenings of the tibiae are more feebly developed and the scale-like basal seta of genu III is narrow-

ly lanceolate, about 6 times longer than its maximum width and edged with long barbs.

♂. The epiandrium is fairly long and narrows towards its end; p_1 and p_2 are equal in length, twice as short as p_3. Length 350 to 400μ.

♀. Unknown.

Distribution. It has been recorded from Borkum Island, Germany; in the U.S.S.R. it was found in Smolensk and Jitomir.

Ecology. Isolated specimens were found in granaries, in wheat and flax seed.

2. Subgenus Glycyphagus s.str.

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Sect. Biol. N.S., XLV, 264, 268 to 269.

Anteriorly, the idiosoma has a longitudinal, darkly sclerotised, crista metopica; d_2 are considerably displaced posteriorly, so as to form a transverse row with d_3, or else they are anterior to d_3. The tarsi have no ensheathing scale, only a few fairly long pectinate setae, of which the longest arise near the middle of the ventral surface; the ventral seta of femur I is pectinate.

The larvae have relatively large, cylindrical, well-sclerotised "brustst iele". The resting hypopus is a round, unsegmented body, completely devoid of legs, coxal-sternal skeleton and genital slit. The hypopial case is pigmented and covered with dense, wavy reticulations.

The subgenus Glycyphagus s.str. contains 3 widely distributed species, which differ more sharply from each other than those of the preceding subgenus; of particular interest are the great differences in the development of characters typical of the subgenus.

6. Glycyphagus (s.str.) cadaverum (Schrank) Ouds. (Figs. 486 to 488.)

Schrank, 1781, Enum. Ins. Austr. No. 1055 (Acarus); Oudemans, 1905, Entomol. Ber., I, 238; 1913, ibid., III, 328. - prunorum Hering, 1838, Act. Acad. Leop., XVIII, 1: 619, t. 45, figs. 16, 17. - privatus Oudemans, 1903, Entomol. Ber., 1: 103; 1904, Tijdschr. Ned. Dierk. Ver., VIII, 232.

V a arise at the anterior end of an elongated crista metopica, which extends backwards to the level of sc i; the distance between the latter and v p is 2 to 3 times less than the distance between v a and v p; d_2 arise in the same position as in species belonging to the subgenus Lepidoglyphus, i.e. slightly anterior to d_3 and on the same transverse line as l_1; they are separated from each other by a distance equal to that between d_2 and l_1. The pectinate setae of the idiosoma are fairly thin and flexible, the longest being the same length as the idiosoma or slightly longer; p_1 is less than half the length of p_2, and p_3 are slightly longer than p_2; all are pectinate.

The tibiae of the legs are not widened distally like funnels; the pectinate setae are relatively thin; the ventral setae of tibiae III and IV are at a noticeable distance from the distal edge of the segment; the ventral setae of tarsi IV are equidistant from each other; the sensory rod of genua I and II is short, almost conical, that of tarsi II is unthickened.

♂. The epiandrium has a very short protrusion; the posterior pair of genital setae and pr a are short; tarsi I and II are normal; the pectinate setae of tibiae I and II are not modified. Length 280 to 360μ.

♀. The genital opening is very large, extending posteriorly as far as the posterior edge of acetabula IV, the distance separating it from the anal slit is considerably less than its length; the epigynium is triangular; the posterior pair of genital setae is on the same level as the posterior edge of the genital opening. Length 375 to 450μ.

The hypopus and other immature stages are unknown.

Distribution. It has only been recorded with certainty from Holland and U.S.S.R. (Kirjach, Ivanovsk region, Smolensk and other places in the Smolensk and Kalininsk regions, and in Bashkiria).

Ecology. It lives in houses and warehouses, mainly on the seed of grasses, clover and flax, more seldom on grain; near the town of Kirjach it has also been found in fields, on the threshing floor and in the piles of debris left after winnowing.

7. Glycyphagus (s.str.) domesticus Deg. (Figs. 77, 482 to 485.)

Degeer, 1778, Mém. hist. Ins., VII, 87, No. 1, t. 5, figs. 1 to 11 (Acarus); Berlese, 1884, XIV, No. 3; Michael, 1901, 238, t. VI, VIII, figs. 3, 7 to 10, 12, 14, 16; Oudemans, 1904, Tijdschr. Ned. Dierk. Ver. (2), VIII, 218, t. IX, figs. 28 to 34. - hippododos Hering, 1838, Act. Acad. Leop., XVIII, 1: 607, t. 44, fig. 11 (Sarcoptes). - cursor Gervais, 1841, Ann. Sci. Nat., Sér. II, vol. XV, 18, t.2, fig. 15; Fumouze et Robin, 1867, Journ. Anat. Physiol., V, 569, 573; Troupeau 1879, 110, t.2, figs. 12 to 16, 18 to 19.

Biology. Michael, 1888, Journ. Linn. Soc. Lond., XX, 285; Hora, 1934, Ann. appl. biol., XXI, No. 3, 483 to 494.

V a arise from a special wide area (area sensilligera) in the middle of the crista metopica, at a considerable distance from the anterior edge of the idiosoma; the anterior half of the crista (which is in front of v a) is broad and more feebly sclerotised than the narrower posterior half, this extends posteriorly to the level of v p; the distance between the latter and sc i is only 1.5 times less than the distance between the sc i setae, and less than 1.5 times shorter than that separating v a and v p; d_2 are placed between d_3 and form a straight transverse row with them; the distance between the d_2 setae is about half that separating them from d_2 and l_1. The pectinate setae of the idiosoma are

fairly thick, and somewhat stiff, the longest of them being half the length of the idiosoma, rarely slightly longer; p_1 and p_2 short, approximately equal in length and 2 to 2.5 times shorter than p_3.

The tibiae are normal in structure, not enlarging towards their distal ends; the pectinate setae of the legs are fairly short and thick; the ventral setae of tibiae III and IV are fairly far removed from the distal edge of the segment; the ventral setae of tarsus IV are equidistant from each other; the sensory rod of genua I and II is long, thin and cylindrical; the sensory rod of tarsus II is considerably longer than that of tarsus I.

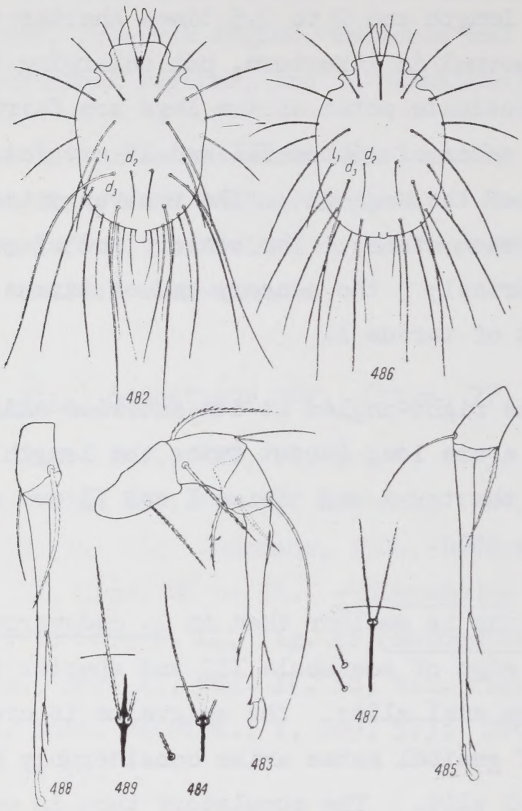
♂. The epiandrium is right-angled at its anterior end; the posterior genital setae and pr a are long (about twice the length of the anal slit); the ventral setae of the tarsi and tibiae I and II are normal in structure. Length 270 to 350μ.

♀. The genital opening is smaller than in G. cadaverum, barely reaching beyond the posterior edge of acetabula III and shorter than the distance separating it from the anal slit; the epigynium is crescentic in shape; the posterior pair of genital setae arise considerably behind the posterior end of the genital slit. The copulatory tube is very wide, cylindrical and membranous in consistency. Length 350 to 680μ.

In the larva the crista metopica is similar in structure to that of the adult, but is more feebly sclerotised; d_2 occupy already a definite position. The hypopial skin is a pale, smoky brown in colour.

Distribution. Europe and the palearctic region of Asia; it is also found in the Arctic (Franz Joseph Lane, Spitzbergen, Greenland), also in Tierra del Fuego, where it was probably introduced in food stores by collectors. It has also been imported into other countries in a similar way.

Ecology. A synantropic, mainly domestic species, living on various dried



Figs.482 - 489

Fig.482 - Glycyphagus (s.str.) domesticus Deg., ♀, ventral surface. Fig.483 - Gl. (s.str.) domesticus Deg., leg I, ♂. Fig.484 - Gl. (s.str.) domesticus Deg., crista metopica. Fig.485 - Gl. (s.str.) domesticus Deg., tibia and tarsus IV, ♀. Fig.486 - Gl. (s.str.) cadaverum Schrank, ♀, dorsal surface. Fig.487 - Gl. (s.str.) cadaverum Schrank, crista metopica. Fig.488 - Gl. (s.str.) cadaverum Schrank, tibia and tarsus IV, ♀. Fig.489 - Gl. (s.str.) ornatus Kram., crista metopica. (Lettering as in fig.27).

plant and animal substances, sometimes multiplying to such enormous numbers that it becomes a serious pest. In warehouses and granaries, it is not so common as G. destructor and does not play such an important part as other species of the Tyroglyphoidea. It has been found in ricks, and straw sweepings. According to Hora 1934, the optimum conditions for G. domesticus are temperatures of 23 to 25°C. and a relative humidity of 80 to 90%; at a relative humidity of 60%, the mites die quickly and at 70% they develop slowly. Furthermore, at an optimum temperature and humidity, the incubation period of the eggs is about 5 days and the post-embryonic development about 17. The hypopus is formed independently of external conditions and about 40% of all individuals pass through this stage; the duration of the hypopial stage varies from 5 days to 6 months.

8. Glycyphagus (s.str.) ornatus Kram. (Figs. 51, 489 to 492.)

Kramer, 1881, Ztschr. ges. Naturwiss., LIV, 435; 1899, 146; Berlese, 1886, XXIX, No. 3; Canestrini, 1888a, 385.

V a arise from a specially widened region in the middle of the crista, fairly far removed from the anterior edge of the idiosoma; both halves of the crista are the same shape and they narrow towards either end; the crista is more strongly sclerotised than in G. domesticus, the posterior half extending as far back as the level of v p; the distance between the latter and sc i is only slightly less than that between both sc i setae and between v a and v p. D_2 arise between d_3, even slightly behind them, forming with them an anteriorly convex arch; the distance between the d_2 setae is half the distance between them and l_1. The pectinate setae of the idiosoma are thicker and longer than in the neighbouring species, and they are fairly stiff; p_1 and p_2 are equal in length, fairly long, although only half the length of p_3; all the setae are pectinate.

The tibiae are slightly widened distally into funnel-shaped structures; the pectinate setae of the legs are thick and comparatively long;

the ventral setae of tibiae III and IV arise from the deep depressions at the distal end of the segment (as in G. michaeli and G. burchanensis); on tarsi IV both proximal setae are very near to each other and far from the distal ones; the sensory rod of genu I and II is long, thin and cylindrical, that of tarsus II being considerably larger than the corresponding sensilla of tarsus I.

♂. The epiandrium is feebly developed, with a short obtuse protrusion. Tarsi I and II are sharply bent into an S-shape; the external ventral seta of tibiae I and II is modified into a large triangular "comb", bearing 8 to 10 (tibia I) and 4 to 5 (tibia II) sharp teeth; the internal ventral seta of the same tibia is shortened. Length 430 to 500μ.

♀. The length of the genital opening is much less than the distance between it and the anal slit; its posterior edge is on a level with epimeres III; the epigynium is small and crescentic in shape, with laterally extended edges; the posterior pair of genital setae is placed considerably behind the genital opening. The ventral setae of tibiae I and II are not modified, the tarsi are straight. The copulatory tube is narrow, becoming narrower towards its end, it has thickened walls. Length 510 to 600μ.

The larva has no crista. D_2 are placed as in G. cadaverum and in species belonging to the subgenus Lepidoglyphus, i.e. slightly anterior to d_3; all the setae of the idiosoma, except d_3, are very short. The crista first appears in the protonymph as a narrow, lanceolate, sclerotised strip, lying behind v a, and only in the telonymph does it acquire a definite structure; in the protonymph d_2 are noticeably anterior to d_3, but nearer than in the larva. The hypopus is not known.

Distribution. Germany, England, Holland, Italy and U.S.S.R. (Moscow, near Leningrad, Kiev, Bashkiria - the Sterlitmaksk region).

Ecology. This species lives in the burrows of rodents and insectivores

(mole, shrew mouse), where it is sometimes found in large numbers. G. ornatus also lives in hay debris from stables, and sometimes in moist grain (wheat) and oil-containing seeds in granaries; Poppe 1906 also found it living with bats and Newstead and Duvall scraped it with dry mud from horses.

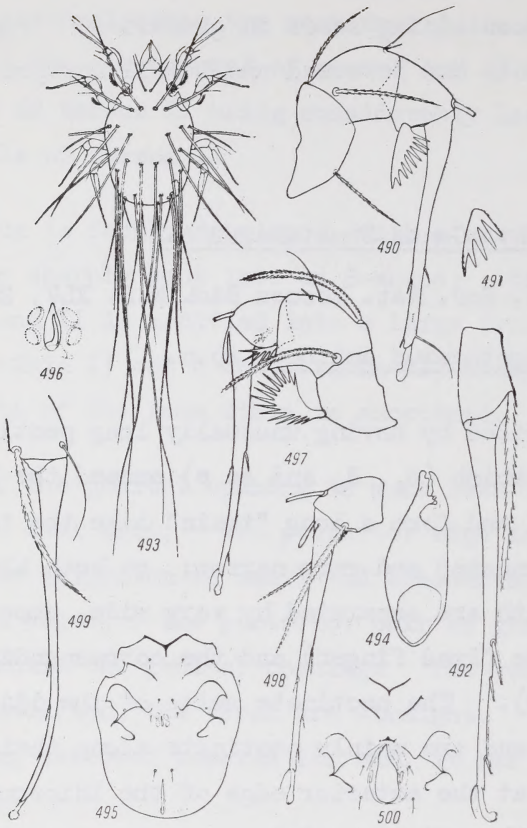
4. Genus Cometacarus A.Z.

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Biol. N.S. XLV, 265, 269.

Type species: Cometacarus smirnovi sp.n.

This is characterised by having unusually long pectinate setae on the idiosoma, some of which (d_3, d_4 and sa e) exceed the length of the body by 2.5 to 3 times and form a long "train" like the tail of a comet. The chelicerae are elongated and very narrow; on both blades of the shears, the apical teeth are separated by very wide, smooth spaces from the basal tooth (on the fixed finger) and the corresponding indentation (on the movable finger). The pectinate setae of the idiosoma are flattened dorso-ventrally and are mainly pectinate along their edges. V a are wide apart, right at the anterior edge of the idiosoma, whilst v p are close together; there is no crista; sc are near together, forming a straight transverse row; there are 3 pairs of humeral setae (h a, h p and sh); d_2 are considerably displaced posteriorly and arise between d_3, forming with them a transverse row; p a are fairly short, approximately equal in length and pectinate. The pseudostigmatic organ is divided into 2 branches right from the base. The external ends of epimerites III are fused with epimeres IV; from the point where the internal ends of epimeres III and IV meet, a thin, hook-shaped sclerite extends internally.

The tarsi have no pectinate sheath, but 3 to 4 fine pectinate setae (3 ventral and 1 dorsal on tarsi I and II), only 3 ventral setae arise from tarsi III and IV; the sensory rod on tarsi I and II is spindle-shaped, the apical dorsal seta of tibia III is short.



Figs.490 - 500

Fig.490 - Glycyphagus (s.str.) ornatus Kram., leg I, ♂ . Fig. 491 - Gl. (s.str.) ornatus Kram., comb-shaped seta of tibia II, ♂ . Fig.492 - Gl. (s.str.) ornatus Kram., tibia and tarsus IV, ♀. Fig.493 - Cometacarus smirnovi, sp.n., ♂ , dorsal view. Fig. 494 - C. smirnovi, sp.n., chelicera, ♀. Fig.495 - C. smirnovi, sp.n., ♂ , ventral surface. Fig.496 - C. smirnovi, sp.n., genitalia of ♂ . Fig.497 - C. smirnovi, sp.n., leg I, ♂ . Fig.498 - C. smirnovi, sp.n., tibia and tarsus IV, ♀. Fig.499 - C. smirnovi, sp.n., Ditto, ♂ . Fig.500 - C. smirnovi, sp.n., genital opening of ♀.

♂. The genital opening is placed between the bases of legs IV; it has well-developed oval suckers; the epiandrium is absent.

♀. The genital folds are more or less reduced and do not meet along the mid-line of the body; genital suckers are absent; the epigynium is shaped like a roof; the anterior pair of genital setae are placed along the sides of the epigynium.

Here belong 3 very rare species, of which one is insufficiently known and requires redescribing.

Cometacarus A.Z.

1(2) Very small species: total length of the ♂ 175, of the ♀ 200μ; v p the same length as sc i and a third longer than sc e; d_2 3 times shorter than d_3; pectinate setae of the legs very long, the external basal seta of genu I being as long as the tarsus; ♂ without fan-shaped folds arising from femora I and II. Germany.

2. C. oudemansi A.Z.

2(1) Larger species: total length of ♂ 400 to 420μ, of the ♀ 500 to 510μ; v p half the length of sc e and one-third that of sc i; d_2 half the length of d_3; pectinate setae of the legs fairly short, the external basal seta of genu I half the length of the tarsus; ventral setae of femora I and II modified to form large fan-shaped folds in the ♂. U.S.S.R. (Ivanov).

1. C. smirnovi sp.n.

1. Cometacarus smirnovi sp.n. (Figs. 493 to 500.)

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Biol. N.S. XLV, 265 (nom. nudum).

A fairly large species. V p are twice as short as sc e and almost 3 times as short as sc i; h i are 1.5 times shorter than d_2, which are

half the length of d_4 - the longest setae of the idiosoma - and almost 1.5 times shorter than d_3; d_4 are not more than 2.5 times longer than the body (including the gnathosoma).

Legs I and II are rather more powerful than the posterior ones; the ventral distal edge of genua I and II is drawn out into a sharp angular projecting tooth; the pectinate setae of the legs are fairly short and thin; the sensory rod of tarsi I and II has a rounded end.

♂. The genital opening is placed between the bases of legs IV and has a pair of large, oval genital suckers. The penis is very thin, slightly S-shaped; an epiandrium is absent. The ventral setae of femora I and II are modified to form large, fan-shaped plates, with deeply serrated edges and folded into 2 halves along a longitudinal line; the ventral setae of tibia II are also very strongly modified, the external one being shaped like a comb with 5 to 6 protrusions, and the internal one is split into 4 needle-shaped sections, like the fingers on a hand; the internal setae of tibia I are short, but unmodified. Length of idiosoma 320 to 340μ. Total length of body 400 to 420μ.

♀. The genital opening is relatively small and is completely enclosed by the bases of legs III and IV; the epigynium is small and the anterior genital setae, on either side of it, are close together; the ventral setae of all the tibiae and genua are normal. Length of idiosoma 400 to 430μ. Total length of body 500 to 510μ.

Distribution. It has only been found once in the town of Ivanov, where a small colony of this remarkable species was found in parsnip seed in a store.

2. Cometacarus oudemansi A.Z. (Figs. 514 to 517.)

Zachvatkin, 1936, Bull. Soc. Nat. Moscou Biol. N.S. XLV, 265; - setosus Oudemans, 1907, Abh. naturwiss. ver. Bremen, XIX, 60, t. II, figs 6 to 11 (non C.L. Koch, 1841) (Glycyphagus).

An extraordinarily small species, much smaller than any other representative of the family, except the dwarf males of Orycteroxenus. V p are the same length as sc i and one-third longer than sc e; h i are slightly shorter than d_2, the latter being 3 times shorter than d_4 and almost 2.5 times shorter than d_3; d_4 are 3 times longer than the body (including the gnathosoma); legs I and II are much more massive than the more slender legs III and IV; the ventral distal edge of genua I and II is rounded and does not project at all; the pectinate setae of the legs are very long; the external basal seta of genua I and II is equal in length to the tarsus; the sensory rod of tarsi I and II has a thin pointed end.

♂. In Oudemans' work, it says that the ♂ only differs from the ♀ in, what he calls, details of genitalia; one can conclude from this that the ventral setae of tibiae and femora I and II are not modified. Total length of body 175μ.

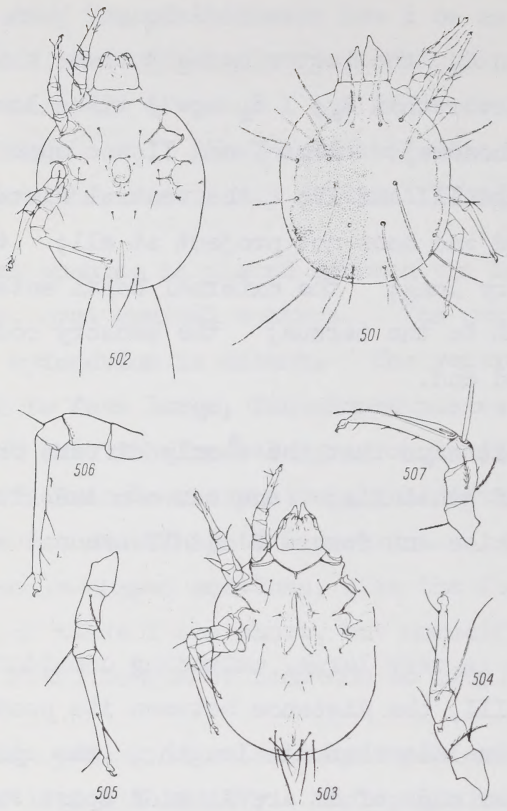
♀. The genital opening is very large, extending considerably anterior to the ends of epimeres III, the distance between its posterior end and the anal slit is 2.5 times less than its length; the epigynium is large, the setae on either side of it are as wide apart as the middle and posterior genital setae; all the pectinate setae of the legs are normal. Length of idiosoma about 165μ; total length of body 200μ. Immature stages are unknown.

Distribution. Germany (near Bremen). The place where they were found is not mentioned.

3. Cometacarus setosus Koch (Fig. 518.)

C.L. Koch, 1841, Dtsch. Crust., Myriap., Arachn., XXXIII, No. 3 (Acarus).

An insufficiently described species, differing from the 2 preceding ones in having long pectinate setae arising from the base of genua I and II, these are thickened distally. The length of the body is not given.



Figs.501 - 507

Fig.501 - Aëroglyphus peregrinans Berl., ♂, dorsal surface. Fig.502 - Ditto, ventral surface. Fig.503 - A. peregrinans Berl., ♀, ventral surface. Fig.504 - A. peregrinans Berl., leg I, dorsal view. Fig.505 - A. peregrinans Berl., leg III, ventral view. Fig.506 - A. peregrinans Berl., leg IV, lateral view. Fig.507 - Ctenoglyphus plumiger C.L. Koch, leg I, ♂ .

It was found in Germany in old hay.

3. Subfamily Aëroglyphinae

The chelicerae are moderate in size, fairly massive, resembling those of Chortoglyphus in shape. The idiosoma is wide, elliptical and flattened, without a transverse groove or rostrum. The cuticle is covered with thin, dense, transverse striations, which are only absent in that part of the body occupied by the well-defined propodosomal shield; the dorsal surface of the body is covered with numerous triangular spines (squamoids). The setae arising from the dorsal surface of the idiosoma are moderate in length (approximately 20 to 50% of the idiosoma in length); they are all alike, slightly flattened and densely and finely pectinate, especially along the edges. Sa e and sa i are longer and thinner than the others; v p are lateral in position, on the same transverse line as v a and considerably shorter in length; there are 3 pairs of lateral and scapular setae and 2 postanal setae in the ♂ and 4 in the ♀; their position is normal. The pseudostigmatic organ is absent. The genital suckers are small, but completely visible. The coxal-sternal skeleton is feebly developed; the sternum and epimeres II to IV are short and free and the ends of epimerites II are fused with epimeres III.

The legs are moderate in length and fairly slender, with slightly bent tarsi; the setae of genua and tibiae are slightly pectinate; th apex of genu I has 2 sensillae: a small sensory rod and, next to it, a long, stiff seta; the apical setae of tibiae II and III are very short. The praetarsi are small, with relatively large sickle-shaped claws. Secondary sexual characters are feebly developed.

♂. The genital opening lies between the bases of legs III and IV; the penis is very small and an epiandrium is absent.

♀. The genital opening lies between legs III and IV; it is fairly large, devoid of epigynium and circumgenital ring.

Immature stages are unknown.

To this subfamily belongs only 1 genus, Aëroglyphus gen.n. (it is possible that Glycyphagus robustus Banks 1906 from N. America also belongs to this genus, but its inadequate description makes it difficult to be certain of this); this is biologically associated with Hymenoptera; contrary to other symphylic forms, Aëroglyphus is distributed in the adult stage by the host.

5. Aëroglyphus gen.n.

Type species: Glycyphagus peregrinans Berl. 1892.

A fairly large species. Almost the whole dorsal surface is covered with small triangular squamoids, which are slightly larger in size and closer together at the edges of the region which they occupy, thus giving it a clearly defined outline; in the anterior part of the idiosoma, the cuticle is noticeably thickened, forming a propodosomal shield with 2 smooth, shallow longitudinal ridges, these extend posteriorly as far as the sc setae, then diverge outwards in the form of an arc and gradually merge with the surface of the shield. H a and h p are dorsal, sh lateral in position; d and l setae become gradually shorter in length, from the anterior to the posterior regions of the body, so that d_1 and l_1 are longer than the other setae of each group. This is a monotypical genus, with 1 species: Aëroglyphus peregrinans.

1. Aëroglyphus peregrinans Berl. (Figs. 501, 506.)

Berlese, 1892, LXV, No. 1; Kramer, 1899, 147 (Glycyphagus).

The idiosoma is 1.25 to 1.3 times longer than its width, with scarcely marked scapular protrusions, and regularly convex anterior and posterior edges. It is pale in colour, with a light greenish tinge; the legs are non-pigmented. V a are more than 1.5 times longer than v p and approximately equal in length to sc i; sc e are slightly longer than sc i,

forming a transverse row with them. The approximate lengths of the setae of the idiosoma are: v a 26 to 30, v p 18 to 20, sc e 33 to 42, sc i 28 to 30, h a 33 to 37, sh 26 to 28, h p 38 to 41, d_1 50 to 54, d_2 48 to 50, d_3 43 to 48, d_4 37 to 40, l_1 44 to 48, l_2 38 to 45, l_3 33 to 35, sa e 60 to 66, sa i 54 to 60% of the length of the idiosoma. Length of ♂ is 350 to 370μ, width 280 to 300μ; length of ♀ is up to 415μ, width 315μ.

Distribution. Italy; I have only found it in the village of Lujky on the Oka, near Moscow.

Ecology. Both sexes were found in small groups on Xylocopa violacea L. and X. valga F., and sometimes on Bombus lapidarius L.

4. Subfamily Ctenoglyphinae

The species are very small, 180 to 300μ. The chelicerae are normal in structure. The idiosoma is broad and flattened dorso-ventrally, with or without a fairly distinct transverse groove. The cuticle is thick, rough, wrinkled or covered with large warts, which are more or less strongly pigmented. The setae of the dorsal and lateral surfaces of the idiosoma are coarsely bipectinate or leaf-shaped; v p are dorsal, and posterior to v a (sometimes absent); there are usually 3 pairs of scapular setae and 5 pairs of laterals; they are all marginal, including the postanals, and together form a luxuriant fringe around the body; the sacral setae are sometimes displaced on to the dorsal surface, and are always relatively short. A pseudostigmatic organ is absent. The genital suckers are small, but clearly defined. The coxal-sternal skeleton is well-developed, differing in structure in ♂ and ♀.

The legs are fairly massive and long (in ♂ Ctenoglyphus), their setae smooth and thin; the dorsal apical setae of tibiae I and II are very long, the ventral ones sometimes absent; the apex of genu I has 2 sensillae; the praetarsi are small and the claws of medium size.

The morphological differences between ♂ and ♀ are often very great; they may be shown in size (the ♂ is often a dwarf), shape of idiosomal setae, structure of coxal-sternal skeleton, length of leg, etc.

♂. The penis is tubular, usually very long, lying in the free space between coxae I to II, sometimes reaching the gnathosoma. An epiandrium is absent.

♀. The genital opening is wide, placed between legs III and IV, with a well-developed epigynium.

Nymphs are characterised by having less complicated setae. So far as is known, no species form hypopi, the large surface area of the adults enables them to be carried by the wind and thus act as the distributive phase. Nearly all species of the Ctenoglyphinae live in hay or dusty plant residues. To this subfamily may also belong Glycyphagus (Dermacarus) fuligineus Berl. 1921 from Italy.

4. Subfamily Ctenoglyphinae

Key to the adults

1(2) Idiosoma edged with only 7 pairs of setae, of which 6 are leaf-like, asymmetrical, with a strongly indented edge and 1 is very long and simple; v, sc and d wedge-shaped, truncate at the end.

8. Nycteriglyphus gen.n.

Only 1 species, M. pterophorus Berl., Italy.

2(1) Idiosoma edged with 11 to 12 pairs of pectinate setae, palmate or leaf-like in shape, always symmetrical; v, sc and d similar to the peripheral setae or thinner and densely ciliate in appearance.

3(4) Males differing little from the females in general shape and in the structure of the setae; in both sexes the cuticle of the dorsal surface is rough; the setae are narrow, flat, widely and

finely pectinate; v, l_1 to l_2 and sc wider than the others.

6. Diamesoglyphus gen.n.

Only 1 species, D. intermedius Can. Italy.

4(3) Males quite different from the females in general shape and in the structure of the setae; in them, the cuticle is rough or almost smooth, the setae of the dorsal surface are long, relatively narrow, the idiosoma is distinctly globular, with a rounded outline; in the females the idiosoma is very flat, almost pentagonal, the cuticle of the dorsal surface is coarsely wrinkled or covered with distinct tubercles with divided ends; the setae of the dorsal surface (or the peripheral ones at least) are very wide, palmate or leaf-like.

7. Ctenoglyphus Berl.

6. Genus Diamesoglyphus gen.n.

Type species: Glycyphagus intermedius Canestrini 1888.

A small species in which sexual dimorphism is completely absent. The idiosoma is widely elliptical, with feebly marked scapular protrusions, widely rounded posterior edge and no transverse groove. The cuticle is very finely roughened. The setae of the dorsal surface of the idiosoma are all alike: flattened, but of varying widths; they are finely and thickly pectinate along the edges; v a are dorsal in position, placed at a distance from the anterior angles of the idiosoma and similar in structure to v p; all the scapular and lateral setae are lateral; d_3 are the same distance apart as d_2; sa e and sa i are terminal; p a are also terminal and pectinate. All the coxal fields are open.

♂. The genital opening is between the bases of legs IV; the penis is of medium length, gradually widening towards the base.

♀. The genital opening is between the bases of legs III and IV, it is wide, with a distinct circular outline and a feebly developed epigynium; the copulatory tube is reduced.

The nymphal stages are unknown.

To the genus Diamesoglyphus belongs 1 species from Italy, which has not been sufficiently described.

1. Diamesoglyphus intermedius Can. (Fig. 527.)

Canestrini, 1888, 20; 1888a, 386, t. 26, fig. 2; Kramer, 1899, 147, (Glycyphagus).

The relative length of the idiosoma in proportion to its width is 1.4 to 1.5:1. The setae of the dorsal surface decrease in width gradually towards the posterior end of the body; v, sc and h a are wider than all the others; v a are half the length of v p and equal to sc i; sc e are noticeably shorter than sc i and approximately equal in length to h a, h p and sh; the lateral setae increase in length towards the posterior end of the body to the level of l_4; all the dorsals are very long; the approximate lengths of the setae of the ♂ (according to Canestrini) are: v a 25, v p and sc i 60, sc e and h 48 to 55, d_1, d_2, d_4 88, d_3 80, l_1, l_2 60 to 63, l_3 to l_5 75, l_4 88 to 90, sa e 57 to 60, sa i approximately 80, p a 50 to 55% of the length of the idiosoma. The legs are long and slender; the external ventral seta of tibiae I and II is absent. The total length of the body of the ♀ is 300μ, the width 220μ. The size of the ♂ is not mentioned in the description.

Distribution. Italy, in hay.

7. Genus Ctenoglyphus Berl.

Berlese, 1884, XIV, No. 1. - Glycyborus Oudemans, 1903, Tijdschr. Entomol. XVI, 8.

Type species: Acarus plumiger Koch 1835.

Sexual dimorphism is exceptionally strongly marked; the only characters common to both sexes are the presence of a more or less clearly defined transverse groove on the dorsal surface of the idiosoma, the reduction of the ventral setae of tibiae I and II and the apical dorsal setae of tibiae IV, and the small size of the claw.

♂. This is much more conservative in its characters than the ♀, which considerably exceeds it in size (the ♂ is not more than 150 to 190μ long). The idiosoma is moderately convex, egg- or pear-shaped, noticeably widening towards the slightly rounded posterior end and completely lacking in "shoulders". The cuticle is finely roughened or almost smooth, often with a more clearly defined sculpturing. The chaetotaxy of dorsal and lateral surfaces of the idiosoma consists of 16 to 19 pairs of long, bipectinate or often leaf-shaped setae; v a are always bipectinate; v p are always present; there are 3 pairs of h, of which the anterior one arises from the propodosoma; d_1 and d_2 are sometimes reduced or absent, they are wide apart and longer than any of the other setae of the idiosoma (usually equal to or longer than the idiosoma), they are always narrow and finely pectinate along the edges; behind d_4 there are 2 pairs of setae arising from the dorsal surface, evidently homologous with the sacrals - sa i and sa e - but occupying an unusual position for these setae; there are 5 pairs of lateral setae and 0 to 3 pairs of postanals; correlated with the convex shape of the idiosoma is the dorsal position of the peripheral setae. All the coxal fields (or at least those of the anterior 3 pairs of legs) are closed and have a noticeably dense surface, i.e. they give rise to well-defined coxal shields; these are divided medially by a region which widens towards the posterior end of the body (i.e. by a central field), but the shields of each side of the body closely touch each other. The genital opening is very long and occupies practically all the space between the coxal shields; the penis is exceptionally long and shaped like a sabre. The legs are very long (60 to 80% of the length of the idiosoma) and relatively thick; the

apical dorsal seta of tibia I is strongly hypertrophied.

♀. This is much larger than the ♂ (250 to 300μ long). The idiosoma is much flattened dorso-ventrally, with somewhat laminate edges and almost pentagonal in shape; the hysterosoma has sharply protruding shoulders, the lateral edges are straight or slightly concave (sometimes irregular); the posterior edge is usually more or less deeply indented in the middle. The cuticle is unevenly thickened dorsally, coarsely wrinkled or covered with large raised warts; the ventral surface is finely grained. Arising from the dorsal surface are 17 to 21 pairs of setae, shorter than those of the ♂, bipectinate or leaf-shaped; the variation in their number may be due to the absence of v p, sc i and the sacrals; the 3 pairs of humerals, 5 pairs of laterals and 3 pairs of postanal setae are all marginal and encircle the idiosoma; d_1 are sometimes atrophied (in C. palmifer, d_2 and d_3 are also reduced); in some species, d_3 and sometimes all the dorsals and sa e and sa i are represented by narrow, thin and thickly pectinate setae. Epimeres I are joined along the mid-line of the body, forming a short sternum, all the others are free; epimerites II are short, joined with epimeres III. The large elongated genital opening is placed between coxae III and IV, sometimes extending further than the level of the posterior edges of acetabula III; the epigynium is well-developed and the copulatory tube is long and cylindrical, widening towards its base; the anal slit is near the posterior edge of the idiosoma. The legs are of moderate length and slender, the apical dorsal seta of tibia I is more feebly developed than in the ♂.

In the larva, all the setae of the dorsal surface are simple and feebly pectinate; the complexity of structure and shape is developed later (sometimes only in the telonymphal stage); on the other hand, species which lack v p in the adult (C. palmifer) have them well-developed in the nymph.

To this genus belong 4 European species.

Ctenoglyphus Berl.

Males

1(4) All the setae of the dorsal surface are about the same in structure: bipectinate or pectinate, with long barbs; d_1 and d_2 well-developed.

2(3) All the setae of the dorsal surface of the idiosoma, except d_3, bipectinate, with 10 to 20 pairs of strong curved barbs; d_3 finely pectinate; d_2 half the length of d_1. England, Italy, U.S.S.R. (Moscow, Astrakhan).

2. C. canestrinii Arm.

3(2) All the setae of the dorsal surface finely pectinate, each with numerous fine, slightly bent barbs; d_1 barely shorter than d_2. England, France, Germany, U.S.S.R. (Leningrad, Moscow, Ivanov).

1. C. plumiger Koch.

4(1) V a bipectinate, v p, both pairs of sc, h a, h p, sh and the 2 first pairs of laterals, leaf-like, narrowly lanceolate; d_3 and l_3 to l_5 fine, densely and finely pectinate; d_4, sa e and sa i leaf-like, much wider than all the other setae of the idiosoma; d_1 and d_2 reduced or absent. England, France, Germany, Italy.

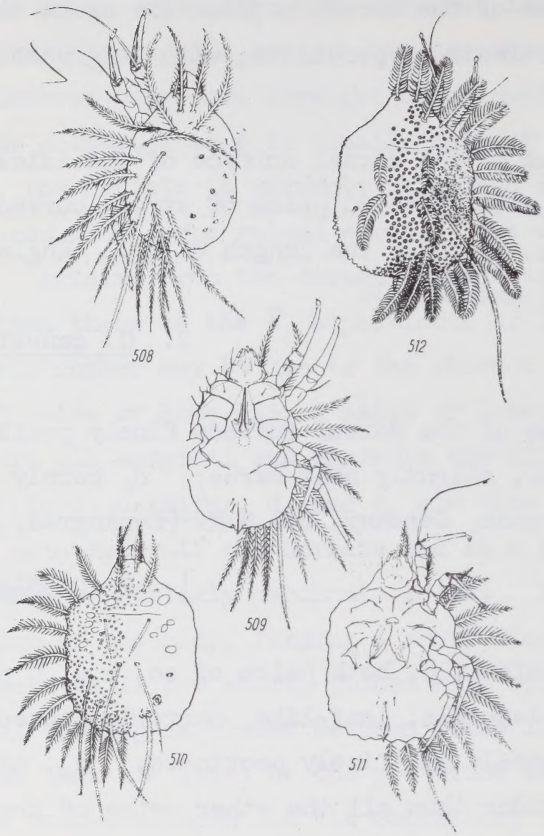
3. C. palmifer F. and R.

Females

1(4) V, sc and all the peripheral setae of the idiosoma bipectinate; dorsal surface cuticle covered with tall cylindrical tubercles with divided ends.

2(3) All the dorsal setae (d_1 to d_4), sa e and sa i narrow, finely pectinate; barbs of the bipectinate setae straight, forming an acute angle with the axis of the seta. England, France, Germany, U.S.S.R. (Leningrad, Moscow, Ivanov).

1. C. plumiger Koch.



Figs.508 - 512

Fig.508 - Ctenoglyphus plumiger C.L. Koch, dorsal surface o
Fig.509 - Ditto, ventral surface. Fig.510 - C. plumiger C.L. Koch, ♀, dorsal surface. Fig.511 - Ditto, ventral surface.
Fig.512 - C. canestrinii Arin. ♀, dorsal surface.

3(2) Only d_3 are narrow and finely pectinate; d_1, d_2 and d_4 bipectinate, the same structure as the peripheral setae of the idiosoma; the barbs of the latter are sharply bent towards the apex of the seta and form a right angle with the axis of the latter. England, Italy, U.S.S.R. (Moscow, Astrakhan).

2. C. canestrinii Arn.

4(1) V, sc and all the peripheral setae of the idiosoma represented by large leaf-like scales; cuticle of the dorsal surface wrinkled, without cylindrical tubercles.

5(6) D_1 and d_2 are very short, lightly pectinate setae; leaf-like setae longer, 20 to 35% of the length of the idiosoma. England, France, Germany, Italy.

5. C. palmifer F. and R.

6(5) D_1 and d_2 leaf-like, similar in structure to the peripheral setae; the latter are short, measuring 15 to 20% of the length of the idiosoma (Glycyphagus palmifer Canestrini 1883, non Fumouze and Robin 1868).

4. C. multifoliatus nom.n.

1. Ctenoglyphus plumiger (C.L. Koch). (Figs. 507 to 511.)

C.L. Koch, 1835, Dtsch. Crust. Myriap. Arachn., V, No. 15; Gervais, 1844, in Walckenaer; Hist. Nat. Ins. Apt. III, 263 (Acarus); Fumouze et Robin, 1868, Journ. Anat. Physiol., V, 67, t. VII; Canestrini, 1888, 21; 1888a, 388, t. XXVIII; Berlese, 1884, XIV, No. 1; Kramer, 1899, 146; Michael, 1901, 250, t. IX, XI, figs. 1 to 7 (Glycyphagus).

♂. The idiosoma widens towards the posterior end of the body, this end being widely rounded. In some places, the cuticle is smooth, in others finely granular. All the setae of the dorsal surface of the idiosoma are very finely and thickly bipectinate (or are long and pectinate), they are long and, on the whole, vary considerably in length; d_3 resemble the other setae in structure, but are noticeably longer. The apical seta of

tibia I is exceptionally long. Length about 200μ, width 120μ.

♀. The idiosoma is 1.4 to 1.45 times longer than its width, with a widely rounded posterior edge. The cuticle of the dorsal surface is covered with cylindrical warts, with ends which are split, so as to form a rosette. V p are well-developed; both pairs of sc, all the humerals laterals and postanals are long, bipectinate (like oriental fans), with straight barbs inclined at an acute angle to the axis; all the dorsals and both pairs of sa are narrow, flexible (ribbon-shaped) and finely pectinate along the edges; the pectinate setae vary in length within the following limits: 20 to 50% of the length of the idiosoma - d_1 are 20, d_2 45, d_3 65, d_4 50, sae 40 to 45, sa i 15% of the length of the idiosoma. Length 280 to 310μ, width 180 to 220μ.

Distribution. Germany, England, France, U.S.S.R. I have found it in Leningrad and near Moscow and Ivanov.

Ecology. It lives in chaff in barns and stables; A.D. Michael records it from old bee combs.

2. Ctenoglyphus canestrinii Arm. (Fig. 512.)

Armanelli, 1887, Acari del fieno della provincia di Padova, 7; Canestrini, 1888, 21, t. 1; 1888a, 396, t. XXIX, fig. 1; Berlese, 1891, LVIII, No. 3; Kramer, 1899, 146; Michael, 1901, 255, t. X to XI, figs. 8 to 23 (Glycyphagus).

♂. The cuticle is similar in appearance to that of C. plumiger; all the setae of the idiosoma, except d_3, are large, bipectinate and similar in structure to the peripheral setae of the ♀ of C. plumiger; they are 40 to 60% of the length of the idiosoma; d_3 are of even diameter, flexible, finely pectinate and almost equal in length to that of the idiosoma. The apical seta of tibia I is moderately long. Length approximately 200μ, width 130μ.

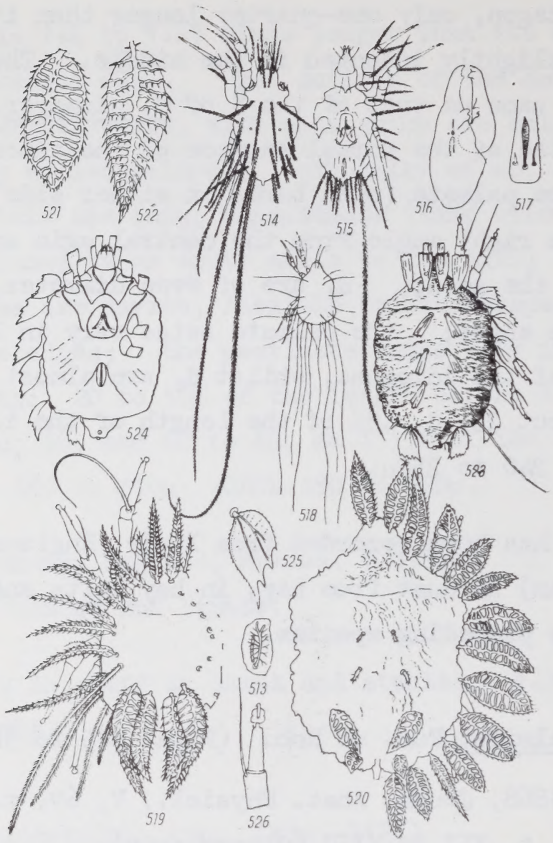
♀. The idiosoma is wider than in the ♀ of the preceding species, almost a regular pentagon, only one-quarter longer than its width; the posterior edge is slightly indented in the middle. The structure of the cuticle is the same as that of the ♀ of C. plumiger. V p are absent; all the setae of the dorsal surface of the idiosoma, with the exception of d_3, are palmate (with barbs on either side), with very long barbs, arising at a right angle from the central axis and bending towards the distal apex of the seta; d_3 are of even diameter, flexible, thickly pectinate at the edges; the palmate setae vary in length from 18 to 40% of the length of the idiosoma, whilst d_3 are almost equal to it in length; d_1 is about 25, d_2 45% of the length of the idiosoma. Length 300 to 320μ, width 240 to 250μ.

Distribution. It has been recorded from Italy, England, U.S.S.R. (near Moscow and Astrakhan) in dust from hay, in hay lofts and stables, often associated with the preceding species.

3. Ctenoglyphus palmifer Fum. et Rob. (Figs. 519 to 522.)

Fumouze et Robin, 1868, Journ. Anat. Physiol., V, 69, t. 8 to 11; Michael, 1901, 200, t. XII to XIII (Glycyphagus).

♂. The lateral edges of the idiosoma are almost parallel to one another over a considerable distance; the posterior edge is very widely rounded. The cuticle is evenly and finely grained. V a are bipectinate; v p, both pairs of sc, all h and l_1 and l_2 are narrowly lanceolate (in actual fact, they are also bipectinate, but there is a thin transparent membrane between the barbs, only the extreme ends of these protrusions are free, and these project like very fine teeth beyond the edge of the lanceolate membrane); d_1 and d_2 are absent (they may be strongly reduced); d_3 and l_3 to l_5 are narrow (like ribbons), thickly and finely pectinate; d_4 and both pairs of sa are widely lanceolate, slightly curved, resembling a cluster of fronds arising from the posterior third of the idiosoma. The approximate lengths of the setae are: v a 25, v p 50, sc e 33, sc i



Figs.513 - 526

Fig.513 - Glycyphagus pilosus Ouds., pseudostigmatic organ of ♂ (after Oudemans). Fig.514 - Cometacarus oudemansi A.Z., ♀, dorsal surface (after Oudemans). Fig.515 - Ditto, ventral surface (after Oudemans). Fig.516 - C. oudemansi A.Z., chelicera, lateral view (after Oudemans). Fig.517 - C. oudemansi A.Z., base of leg I (according to Oudemans). Fig.518 - C. setosus C.L. Koch, dorsal surface (after Koch). Fig.519 - Ctenoglyphus palmifer F and R, ♂, dorsal surface (after Michael). Fig.520 - C. palmifer F and R, ♀, dorsal surface (after Michael). Fig.521 - C. palmifer F and R, one of the peripheral setae of the idiosoma of the ♀ (after Michael). Fig.522 - Ditto, ♂, (after Michael). Fig.523 - Nycteriglyphus pterophorus Berl., ♀, dorsal surface (after Berlese). Fig.524 - Ditto, ventral surface (after Berlese). Fig.525 - N. pterophorus Berl., one of the peripheral setae of the ♀ (after Berlese). Fig.526 - N. pterophorus Berl., leg I (after Berlese).

48 to 50, h a and sh 50 to 55, h p and l_1 60, l_2 approximately 70, l_3 80, l_4 60, l_5 35, d_3 110, d_4 and both pairs of sa approximately 50% of the length of the idiosoma. (It is doubtful whether it is possible to homologise the setae, particularly sa e and sa i at the posterior end of the idiosoma.) The internal edge of tibia I is produced into a short point, its distal seta is extremely long. Length approximately 190μ, width 120μ.

♀. The lateral edges of the hysterosoma are irregularly and unevenly festooned; the posterior edge has a narrow, deep indentation. The cuticle is coarsely wrinkled. V p are absent; all the other setae, except d_1 and d_2, are widely lanceolate and almost elliptical; l_5 are not so wide as the others and are narrowly lanceolate; d_1, d_2 are very short, capilliform, with several sharp protrusions; d_3 and d_4 are shaped like leaves. The lengths of the peripheral setae are 23 to 38, d_1 approximately 4, d_2 5, d_3 23 to 25, d_4 10% of the length of the idiosoma. Length approximately 260μ, width 170μ.

Distribution. It has only been recorded from France, Great Britain, Italy and Germany. It lives in the dust of cellars and the chaff in stables.

4. Ctenoglyphus multifoliatus nom.n.

palmifer Canestrini, 1888a, 390, t. XXXVI, fig. 1 (Glycyphagus) (non Fumouze et Robin, 1868).

♀. It differs from the ♀ of C. palmifer F. and R. by the more rounded and regular outline of the idiosoma and by having shorter leaf-like setae (these are not more than 16 to 20% of the idiosoma in length), which evidently have a more uniformly elliptical shape; d_1 and d_2 are also represented by the same elliptical scales. The total length of the body is approximately 300μ, its width 180μ.

The ♂ has not been sufficiently described or figured; it differs

from that of C. palmifer in having 1 instead of 4 pairs of thin pectinate setae arising from the dorsal surface of the body. Total length of the body 200μ, width 140μ.

Distribution. It was found in hay, near Breshia, Italy.

8. Genus Nycteriglyphus gen.n.

Type species: Glycyphagus pterophorus Berl. 1892.

The idiosoma is approximately hexagonal, with a protruding anterior edge and almost straight, parallel lateral edges (these protrude considerably). The posterior lateral angles are almost rectangular and there is a sharply distinct caudal projection, shaped like a truncate cone; a dorsal transverse groove can be clearly seen. The entire cuticle is thickly wrinkled transversely, almost pleated. Thirteen pairs of setae arise from the dorsal surface, each represented by a large, broad, leaf-shaped scale; sa e are long and thin and slightly pectinate; the post-anal setae are evidently absent (or extremely fine). The legs are short and fairly massive; the apical dorsal seta of tibia IV is the same length as that of tibia III; the claws are large, approximately equal in length to the membranous praetarsus. The ♂ has not been described.

♀. Epimeres I united to form a V-shaped figure, the apex of which is connected by an arched sclerite with the internal ends of epimeres II, thus closing coxal fields II; epimerites II are exceptionally long, extending from the external angles of acetabula II to the posterior edge of the genital opening, thus encircling internally the bases of legs III; epimeres III and IV are not developed. The genital opening lies between the bases of legs III and is a wide ellipse, with a clearly defined circular appearance and small epigynia; the copulatory tube is very short, placed at the apex of the caudal protrusion. The anal slit is removed from the posterior edge of the idiosoma.

The genus has been erected for 1 species, which I have not seen and which has been insufficiently described.

1. Nycteriglyphus pterophorus Berlese. (Figs. 523 to 526.)

Berlese, 1892, LVIII, No. 6; Kramer, 1899, 146 (Glycyphagus).

This is a very small, delicately-coloured species. The relationship of length to width (in the ♀) is 1.45:1. V a, sc i and sc e, d_1 to d_3 are shaped like triangular wedges, each with a truncate, serrated distal edge; sc are considerably wider and longer than v a and d, attaining a length of 22 to 28% of the length of the idiosoma (v a is about 16, d_1 to d_3 13 to 14% of the length of the idiosoma). The dorsal setae are equidistant from each other, forming 2 parallel longitudinal rows; h a and h p, l_1 to l_3 and sa i are completely lateral in position arising from the circular edge of the body; all the setae are approximately the same in shape, obliquely asymmetrical, with deeply serrated external edges; these serrations form 5 to 7 sharp teeth (of which the apical ones are the largest), at the apices of longitudinal ridges; the lateral edges of all these scales are finely pectinate. The scales vary from 18 to 25% of the idiosoma in length; the length of sa e is half the length of the idiosoma. Total length of the body of the ♂ is 200μ, of the ♀ 250μ.

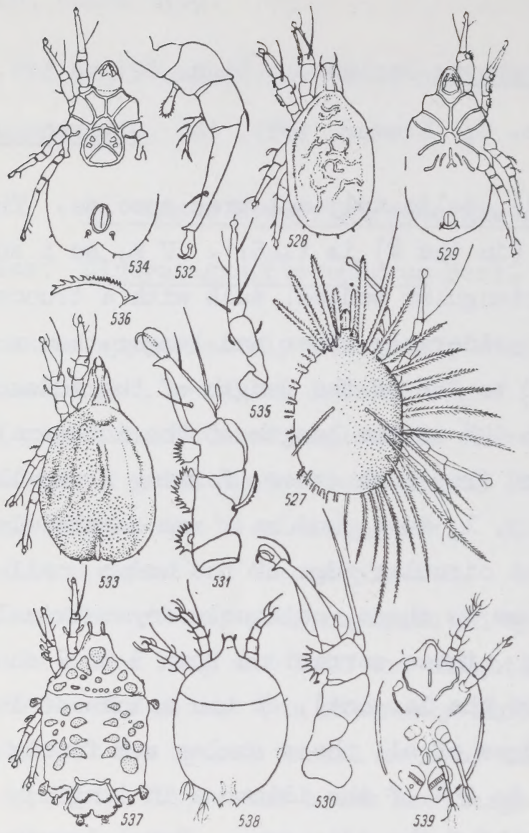
Habitat. Several specimens of this species were found on a bat Nyctalus noctula L. in Padua, Italy, associated with Leiognathus arcuatus.

Species Incertae sedis.

1. Glycyphagus (Dermacarus) fuligineus Berl.

Berlese, 1921, Redia, XIV, 148.

The body is oval, pinkish-grey in colour, ornamented with short



Figs.527 - 539

Fig.527 - Diamesoglyphus intermedius Can., ♀, dorsal surface (after Canestrini). Fig.528 - 539 - Xenoryctes krameri Mich. (after Michael). Fig.528 - ♂, dorsal surface. Fig.529 - Ditto, ventral surface. Fig.530 - Leg I, ♂. Fig.531 - Leg II, ♂. Fig.532 - Leg III, ♂. Fig.533 - ♀, dorsal surface. Fig.534 - Ditto, ventral surface. Fig. 535 - Leg I, ♀. Fig.536 - Basal seta of genu I, ♀. Fig.537 - Telonymph, dorsal surface. Fig.538 - Hypopus, dorsal surface. Fig.539 - Ditto, ventral surface.

setae (barely noticeable in the ♂); all the cuticle is covered with coarse lines; the epistomal setae-v a-are leaf-shaped and pectinate. The epimeres of legs III and IV are joined together at their ends and, in the ♂, are shaped like elongated spatulae. In the ♀ the legs are no thicker than in the ♂; the lateral setae of the body (behind legs IV) are extremely short (half the length of those of Glycyphagus fuscus Ouds. = Gohieria fusca Ouds), bent, with serrated external edges. The penis is long, shaped like a stylet, thin and very sharp (equal in length to tarsus IV, i.e. about 60μ long); it is directed anteriorly and is placed slightly behind coxae IV, with its base close to the large, widely oval, anal opening.

The body of the ♀ is pointed posteriorly, its setae slightly longer than those of the ♂, but not exceeding 30μ in length; they are bent and externally serrated. The genital opening (between coxae III and IV) is surrounded by a trapezium-shaped figure, slightly convex posteriorly and straight anteriorly. Length of the ♂ is up to 350μ, its width 210μ; length of the ♀ is 380μ, its width 280μ.

Distribution. Florence, in hay and chaff (according to Berlese). This doubtful form might equally well be placed in the subfamily Labidophorinae. I am placing it here, on account of the following characters given by Berlese: the structure of the cuticle, the leaf-shaped v a setae (characteristic of some Ctenoglyphinae), the structure and size of the penis and the type of habitat.

5. Subfamily Labidophorinae

In most cases, the gnathosoma is covered dorsally by a rostrum, which overhangs it like a hood; sometimes it is even retracted into a deep depression on its ventral surface (the so-called camerostoma); the chelicerae are small and relatively feeble. The idiosoma is not segmented and varies in shape; the rostrum is usually well-developed, often separated from the rest of the idiosoma by a more or less transverse well-

defined groove. The cuticle, in most cases, is strongly sclerotised, brownish or reddish in colour, smooth, granular or covered with spines; sometimes it is covered with an indented reticulate pattern. The setae of the dorsal surface of the idiosoma are short, often microsetae or short spines, smooth or feebly pectinate; v a are sometimes reduced, v p often completely absent; the number and distribution of the remaining setae is also very varied. In most species, a circular "pore" is present internal to the scapular setae and a pair of similar structures is present near the latero-abdominal or "fat" glands. The genital "suckers" are usually present and are sometimes very large. The coxal-sternal skeleton is strongly developed and of varying structure.

The legs are moderate in length or short, sometimes strongly modified and ornamented with various outgrowths, the setae arising from them also differ in structure, but they are never thickly pectinate; the apex of genu I has 2 sensory setae - a rod-shaped sensilla and a longer seta; the apical setae of tibia I and II are moderate in length, whilst those arising from tibiae III and IV are shorter; the apex of the tarsus bears 2 well-developed apical setae. The praetarsi are all well-developed and elongated, with very small claws.

Secondary sexual differences are usually well-marked and are shown by many different parts of the body: the general shape of the body, the structure of the coxal-sternal skeleton, the chaetotaxy of the legs; sometimes more than one part of the body may be affected and an extreme example is provided by the genus Orycteroxenus, where the ♂ does not resemble the ♀ at all.

♂. Legs III and IV are usually modified, the position of the genital opening varies and the epiandrium is usually well-developed; the penis is small and shaped like a knife.

♀. The genital opening is large, usually occupying the whole space between legs II to IV; it is covered by a pair of well-developed folds and additional unpaired folds may be formed which close the genital opening posteriorly; the epigynium is conspicuous and is usually joined to

the elements of the coxal-sternal skeleton, by a wide, oval, sclerotised ring, which encircles the genital opening (circumgenital ring); a similar ring (circumanal ring) sometimes surrounds the anal slit; the copulatory tube is usually small.

In many species the nymphal stages differ sharply from the adult. Distributory hypopi (Figs. 64 to 65) are often formed; they all belong to the pterophilic type and have the following characters in common: the gnathosoma is completely atrophied and only represented by 2 pairs of short arists. The body is pale in colour, not strongly sclerotised, and is dorso-ventrally flattened. The propodosoma is triangular, always clearly separated from the hysterosoma by a transverse line, although rigidly fused with it; the posterior part of the hysterosoma is usually distinct and forms a sloping, fairly clearly-defined opisthosomal area. The dorsal surface is completely smooth; in some species, however, small areas of the opisthosomal region have a faint, reticulate pattern and along the lateral edges of the body are thin folds of less dense cuticle. All the setae of the dorsal surface are thin microsetae, which are difficult to see; in a range of specimens, some may be absent. The pseudostigmatic organ and eyes are absent. On the ventral surface of the body, there are no clearly defined shields, and the junction between propodosoma and hysterosoma is not clear. A coxal-sternal skeleton is moderately developed and the sternum and epimeres II are never joined; epimeres III sometimes fuse with epimeres IV, so that the widely separated coxal fields III are closed; epimerites II are usually well-developed. In some species, there is a median longitudinal groove on the ventral surface of the body, the edges of which are supported by the ends of epimeres II to IV and epimerites IV. Coxal setae are absent. The genital opening is large, with large, disc-shaped "suckers". The sucking disc is absent and is replaced by a structure which serves to grasp and hold the hair of mammals, which carry the hypopi. This structure consists of 2 wide movable folds (which can open and shut like doors), whose internal surface is transversely ridged; beneath these are 2 pairs of claspers (anterior and posterior), whose ventral surfaces

are also covered with transverse or diagonal ridges; these enable the hair to be securely held between them and the external folds.

The proportions of the legs vary, but in most cases they are fairly massive, legs I, II and II having a well-developed bent claw, without a membranous praetarsus. Legs IV have usually a reduced claw and sometimes a long macroseta. The legs bear the usual series of setae, which are fairly varied in their structure; the apical setae of the tibiae are usually shaped like rods and more or less reduced; the ends of the tarsi each have a simple lanceolate or distally thickened seta. The motile hypopi vary in size from 170 to 430μ. Resting hypopi are unknown.

In my opinion, the subfamily Labidophorinae contains 14 species, belonging to 8 genera; except for the genus Gohieria Ouds. 1939, all these are nidicolous forms, biologically connected with mammals, e.g. Rodents, Insectivores, in whose nests they live; many of them use their hosts as a means of transport for the motile hypopi. Only 1 non-palearctic species of this subfamily is known - Glycyphagus obesus Banks 1906 from the U.S., which belongs to a separate genus.

5. Subfamily Labidophorinae

Key to the genera

Males

1(2) Edges of the idiosoma deeply incised, forming 10 pairs of rounded lobes, of which the majority bear strong pointed setae on their apices. 14. Talpacarus gen.n.

2(1) Edges of the idiosoma neither incised, nor lobed.

3(4) Idiosoma fusiform, narrowing sharply towards either end, very convex, cuticle absolutely smooth, rigid, dark brown in colour; sc e capilliform, all the other setae of the idiosoma represented by fine, flexible microsetae; legs very short, the anterior ones strongly compressed laterally. 15. Fusacarus Mich.

Only 1 species, F. laminipes Mich. England, U.S.S.R. (near Moscow and Irkutsk).

4(3) Idiosoma differently shaped, more or less dorso-ventrally flattened; shape of legs different.

5(6) A larger species, pale in colour; setae of the dorsal surface of the idiosoma fairly long, distinctly pectinate; cuticle soft, finely granular; tarsi III and IV with leaf-like longitudinal keels, the remaining joints without lamellate appendages.

10. Labidophorus Kram.

6(5) A smaller species, dark in colour; setae of the dorsal surface of the idiosoma short or very short, smooth, sometimes like spines; cuticle thick, strongly sclerotised, smooth or coarsely granular; appendages of legs different.

7(8) Very small species (170μ long); cuticle of the dorsal surface covered with large hemispherical granules; all its setae resemble short conical spines; coxal-sternal skeleton feebly developed; legs III and IV entirely hidden beneath the body and directed forwards.

13. Orycteroxenus gen.n.

Only 1 species, O. dispar Mich. England.

8(7) Larger species (250 to 400μ); cuticle smooth or coarsely granular; setae of the dorsal surface of the body stiff, but not spiniform, very distinct or else represented by fine, scarcely visible microsetae; coxal-sternal skeleton well-developed; legs III and IV of normal dimensions.

9(10) Cuticle smooth; setae of the dorsal surface are 10 to 15% of the idiosoma in length, fairly stiff; rostrum without longitudinal ridges; basal joints of the legs ornamented with shallow longitudinal ridges, without leaf-like or denticulate blades; living in

flour and other food products.

11. Gohieria Ouds.

Only 1 species, G. fusca Ouds. England, France, Holland, U.S.S.R. (Moscow, near Ivanov, Caucasus, Barnaoul, Central Asia).

10(9) Cuticle coarsely granular and pitted; rostrum with 2 longitudinal ridges, which are very irregular; all the setae of the idiosoma resemble indistinct, fine, microsetae; basal joints of legs I and II with leaf-like blades, whose free edges are denticulate, tarsi with longitudinal keels with entire edges. Nidicolous species, living in mole and rodent nests.

12. Xenoryctes gen.n.

Females

1(4) Lateral edges of the idiosoma deeply incised, forming irregular lobes or festoons, which bear more or less curved, strong setae on their apices.

2(3) Sternum and epimeres II free; epimeres III united at their ends with epimeres IV; genital opening not encircled by a sclerotised ring; all the 4 pairs of dorsal setae well-developed.

14. Talpacarus gen.n.

Only 1 species, T. platygaster Mich. England, Holland.

3(2) Sternum absent; epimeres I, II, III joined to a wide sclerotised ring encircling the genital opening; epimeres IV short, free; only 2 pairs of dorsal setae (d_2 and d_3), which are very close to each other and nearly in the mid-line of the body.

13. Orycteroxenus gen.n.

Only 1 species, O. dispar Mich. England.

4(1) Lateral edges of the idiosoma entire, without lobes or festoons.

5(6) Idiosoma fusiform (strongly tapering towards either end), very convex; cuticle quite smooth, dark brown in colour; all the setae of the idiosoma, except sc e, are very fine, flexible microsetae; sc e fairly long, capilliform; legs I and II strongly compressed laterally, almost lamellate.

15. Fusacarus Mich.

Only 1 species, F. laminipes Mich. England, U.S.S.R. (near Moscow and Irkutsk).

6(5) Idiosoma a different shape, flattened dorso-ventrally; legs and setae different in shape and structure; cuticle different.

7(8) Sternum and epimeres II free, epimeres III joined at their ends with epimeres IV; epigynium kidney-shaped, distinct from the coxal-sternal skeleton; cuticle whitish, soft, covered with a reticulate pattern; dorsal setae smooth, fairly long, close to the body; legs I and II short. A large species, associated with the beaver.

9. Xenocastor gen.n.

8(7) Sternum joined at its end with the epigynium or the circum-genital ring, or absent; in the latter case epimeres I are joined direct to the epigynium; structure of cuticle and setae different; legs I and II not shortened.

9(12) Cuticle very dense, brownish; rostrum well-developed, concealing the greater part of the gnathosoma; setae of the dorsal surface of the idiosoma short or very short (sometimes scarcely visible), smooth; genital opening encircled by a sclerotised ring. Species of medium size (300 to 450μ).

10(11) Setae of the dorsal surface short, but very clear; cuticle smooth; rostrum without longitudinal ridges; sternum absent - epimeres I are joined directly to the epigynium; basal joints of the legs ridged; distal edges of genua and tibiae widened into

blades; living in flour and other food material.

11. Gohiera Ouds.

Only 1 species, G. fusca Ouds. England, France, Holland, U.S.S.R. (Moscow, near Ivanov, Caucasus, Barnaoul, Central Asia).

11(10) Setae of the dorsal surface of the idiosoma very short, scarcely visible; cuticle coarsely granular and pitted; rostrum with 2 longitudinal irregular ridges; sternum well-developed, joined at its end with the epigynium; basal joints of the legs cylindrical, tibiae each with a leaf-like dorsal keel. Nidicolous species, living in the burrows of moles and rodents.

12. Xenoryctes gen.n.

12(9) Cuticle soft, pale in colour, very finely granular; rostrum absent; setae of the dorsal surface of the idiosoma relatively long, somewhat pectinate; larger species (600 to 1,000μ); no circumgenital ring.

10. Labidophorus Kram.

Hypopi.

1(2) Body narrow, 1.6 to 1.9 times longer than wide; legs I and II long and thin, armed with pectinate setae, their tarsi distinctly curved into an S-shape (when viewed laterally); legs IV very short and thin, ending in a long macroseta, with no claw.

10. Myacarus gen.n.

2(1) Body wider; legs I and II shorter and stronger, bearing simple or spine-like setae; tarsi I and II not S-shaped, more or less conical; legs III and IV moderately shorter than the anterior ones.

3(4) Coxal fields III closed; tarsi IV without apical macrosetae; posterior clasping apparatus spade-shaped, thin, well separated from the anterior one, which is oval and ornamented with radially-arranged

keels; opisthosomal region not defined.

12. Xenoryctes gen.n.

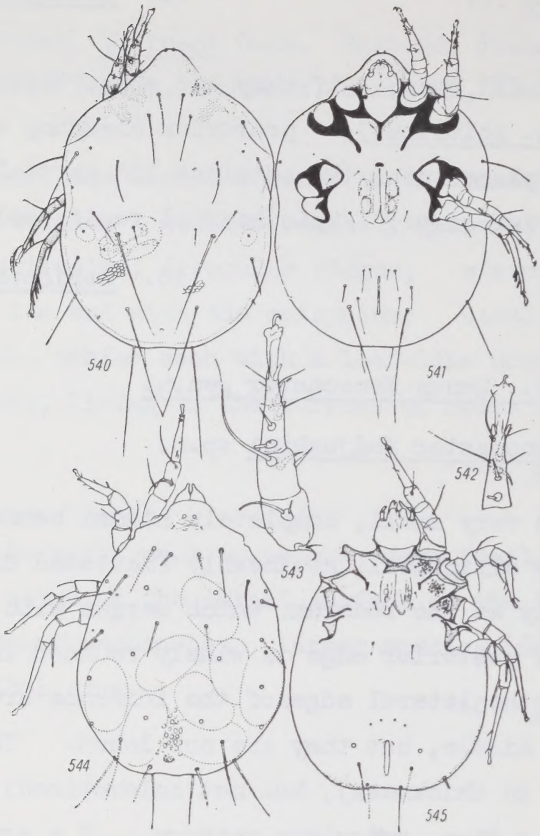
4(3) Coxal fields III open; if they are shut, tarsi IV end in a long macroseta (L. sciurinus); posterior clasping apparatus somewhat triangular, placed near the anterior and partially concealing it with its anterior edges; opisthosomal region well-defined in front.

10. Labidophorus Kram.

9. Genus Xenocastor gen.n.

Type species: Xenocastor fedjushini sp.n.

♀. The gnathosoma is very small, completely hidden beneath the rostrum. The idiosoma is widely elliptical, noticeably flattened dorso-ventrally and extended anteriorly as the rostrum, which merges with the rounded scapular region; the posterior edge is widely rounded and slightly concave in the middle; the lateral edges of the idiosoma are also noticeably concave near the middle, but they are not lobed. The cuticle is very thick (up to 30μ in thickness), but not sclerotised; it is colourless and covered with a fine, reticulate pattern. V a are strongly reduced and represented by very small rod-shaped setae; v p are absent; all the remaining setae of the dorsal surface are relatively long, thin, rather hard and smooth; they are all directed posteriorly and adhere to the surface of the body. The "fat" or latero-abdominal glands are small, but quite distinct. The acetabula of all 4 pairs of legs are surrounded by very strong sclerotised thickenings; the sternum is Y-shaped, free, widely separated from an exceedingly small, kidney-shaped epigynium; epimeres II are free, III and IV joined at their internal ends; epimerites III are represented by short protrusions, which diverge from the middle of epimeres III. The genital opening lies between the bases of legs III and IV, it has no unpaired anterior lobe or sclerotised framework; the genital "suckers" are exceptionally large; the bursa copulatrix is dorsal in



Figs.540 - 545

Figs.540 - 543. Xenocastor fedjushini, sp.n., ♀. Fig.540 - Dorsal surface. Fig.541 - Ditto, ventral surface. Fig.542 - Tarsus II, dorsal surface. Fig.543 - Leg I, dorsal surface. Fig.544 - Labidophorus desmanae, sp.n., ♀, dorsal surface. Fig.545 - Ditto, ventral surface.

position (well removed from the posterior edge of the body) and is not tubular; the anal slit and associated setae are also remote from the posterior edge of the idiosoma; a circumanal ring is absent.

Legs I and II are short, slightly flattened bilaterally; legs III and IV are long and slender; the surface of the joints is smooth, without ridges or lateral outgrowths; the setae of the tibiae and tarsi are mainly bent, smooth and spine-shaped. The ♂ and hypopus are unknown. Only 1 species is known, biologically associated with beavers.

1. Xenocastor fedjushini sp.n. (Figs. 21, 540 to 543, 567.)

♀. Very large and whitish in colour; the gnathosoma, legs and the sclerotised regions surrounding their bases are reddish brown. The idiosoma is 1.4 times longer than its maximum width. The lengths of the setae are: v a 1, sc e 17, sc i 14, h a and sh 15 to 16, h p 28, d_1 14, d_2 6, d_3 35, d_4 38, l_1 12, l_2 28, l_3 21, sa e 55, sa i 9% of the length of the idiosoma. D_2 are considerably posterior to l_1, almost on a level with d_3; the anal setae are smooth and capilliform, p_3 being very long. The genital "suckers" are elliptical and touch at their edges; they are exceptionally large (the anterior ones being 72 by 46μ, the posterior 61 by 41μ). Legs I and II are slightly flattened anteriorly (I 25 and II 27% of the length of the idiosoma). The tarsi are approximately 3 times longer than their diameter at the base and are slightly more than 1.5 times the length of the tibia; they become narrower towards the distal end and ventrally have 2 large spines, which arise one behind the other; the sensory rod is very short and cylindrical and there are long, blunt apical lateral setae; the praetarsus of tarsus I is approximately three-quarters the length of the tarsus; the ventral setae of the tibia are shaped like spines and are close together; near its base, the genu bears dorsally a very short seta, which is split into 3 or 4 branches. Legs III are slightly longer than the anterior ones (28.5% of the length of the idiosoma), but they are considerably more slender; in length the tarsi are almost 5.5 times their diameter

at the base and more than twice the length of the tibia; the tarsi each have 3 large ventral spines and 1 dorsal apical one; in addition, there are 3 fine terminal setae; the ventral seta of the tibia is a long, straight spine. Legs IV are very long (equal to 40% of the length of the idiosoma) and slender, their tarsi being 6 times longer than the diameter at the base, almost 3 times longer than each tibia and more than 4.5 times the length of the praetarsus; the arrangement of setae on legs IV is similar to that of leg III, but the ventral spines of the tarsi are longer, more distal in position and closer to each other, forming a fringed edge. Length 1084μ, width 760μ.

Distribution. It was found in the White Russian part of the U.S.S.R., on the River Berezina.

Ecology. It lives on the beaver (Castor fiber vistulanus Matsch.) Two specimens of this strange species were found by Professor A.V.Fedushin in the spring of 1928 in the beaver's fur; they had attached themselves to the hairiest part of the body (on the abdomen) and were found with fine hair on a comb. (A.V. Fedushin - The River Beaver - published by Glavpushnina NKVT, M., 1935, p. 342.) One of the specimens - ♀ - is in the Z.I.N. collection and has been kindly lent for study by Professor V.V. Redikorzev; the fate of the second one is unknown.

The biology of X. fedjushini is almost unknown; thus it has not been established, for instance, whether it lives in the lining of the host's nest, like other Labidophorinae, or whether it is a true epizoic form, like the well-known Platypsyllus; the latter case seems to be more likely, as Xenocastor has certain well-defined epizoic characters (e.g. a flattened, rounded body, the reduction of v a and v p, setae which follow the curvature of the body and are directed posteriorly, short anterior legs, spines and comb-like setae on the legs, etc.) and also lacks a hypopial form. Another remarkable fact is that the species is viviparous, as, inside the ♀ seen by me, were 2 fully-developed larvae. Cases of facultative viviparity are not uncommon in normal egg-

laying tyroglyphids (Tyrophagus viviparus Ouds., Caloglyphus sp., Glycyphagus destructor Schrank), but in this case it seems to be the rule, rather than the exception.

10. Genus Labidophorus Kramer

Kramer, 1877, Arch. Naturg., XLIII, 1: 149. Dermacarus Haller, 1880, Ztschr. wiss. Zool., XXXIV, 268.

Type species: Labidophorus talpae Kramer 1877 (hypopus).

The gnathosoma is of medium size, free and partially visible from above; the idiosoma is more or less strongly flattened dorso-ventrally, without a well-defined rostrum or projecting lobes. The cuticle is fairly granular, soft, colourless and feebly-pigmented; v a are well-developed, but v p are often reduced; there are 3 pairs of scapular setae, 4 pairs of laterals (l_1 to l_4) and d_2 are considerably anterior to d_3; all the setae of the dorsal surface of the idiosoma are moderate in length (13 to 30% of the length of the idiosoma), straight and more or less definitely pectinate. The latero-abdominal or "fat" glands are well-developed.

The legs are long, slender and unmodified; the surface of the femur, genu and tibia is smooth (without projecting edges or keels); femora I and II are not expanded distally; the leg setae are fairly thin, flexible and slightly pectinate; the ventral seta of tibiae IV is well-developed.

♂. Only known in 1 species. The idiosoma has parallel sides and a widely-rounded posterior edge; v p and d_2 are well-developed; the sternum, epimeres and epimerites II are free (the latter being very short); epimeres III and IV are fused together at their internal ends, which are curved posteriorly; epimerites IV are very short; the surface of the coxal fields is not thickened. The genital opening is behind the base of legs IV and the apex of the penis is directed anteriorly; the anal

slit is long, its folds projecting slightly beyond the edge of the body. Legs I and II are unmodified and have no lamellar extensions; legs III and IV are more massive than the anterior ones, their tarsi having plate-like keels, whose edges are not serrated; the praetarsi are considerably longer than in the ♀, and longer on the posterior rather than the anterior legs.

♀. The idiosoma broadens posteriorly and has a rather concave posterior edge, sometimes it is almost heart-shaped; v p and sometimes d_2 are reduced. Epimeres I are directly fused with a large, crescentic epigynium; epimeres II are free, whilst III and IV are either joined at their internal ends or are free; the coxal fields are outlined by broad, sclerotised thickenings; the genital opening is between the bases of legs II and III and is not surrounded by a sclerotised ring; the unpaired posterior genital fold is absent; the genital "suckers" are of average size, slightly apart and a copulatory tube is absent (the opening is dorsal and on the top of a small swelling); the anal slit is removed from the posterior edge of the body and is not surrounded by a sclerotised ring. The legs have no lamellar extensions and the praetarsi are not enlarged.

The larvae are unknown. In the proto- and telonymphs, v p and d_2 are well-developed and are no shorter than many of the other setae arising from the dorsal surface; they are not abnormal in structure, but tend to be thinner and capilliform; the granulations on the cuticle are coarser, but they are only slightly raised above the surface; the folds of the posterior edge of the idiosoma are only slightly marked.

Hypopus. Its shape and proportions are very varied,but it is always considerably wider than in Myacarus. The coxal-sternal skeleton is well-developed and epimerites II are always well-defined; the structure of the other struts varies in different species; the clasping apparatus also varies in structure and, correlated with this, the shape of the posterior end of the body; in all species, however, the clasping organs

are close together and, when at rest, somewhat overlap each other.

The legs are massive; tarsi I to III each have a large claw and the 3 to 4 slightly flattened, elongated setae are not widened but terminate in button-shaped swellings; the apical seta of the tibia in most cases is shaped like a rod; all the remaining leg setae are smooth (sometimes like spines); tarsi IV have reduced claws and no lanceolate setae.

I consider the genus Dermacarus Haller 1880 to be synonymous with Labidophorus Kram. 1877, owing to the similarity between the adult stages of D. sciurinus and L. desmanae (a species which, in the structure of its hypopus is closely related to L. talpae and undoubtedly belongs to the same genus). The genus Labidophorus is thus enlarged to include 5 palearctic species, which are biologically connected with rodents and insectivores; of these 5 species, up to now 3 are only known as the hypopus.

Labidophorus Kram.

Adults.

Females

1(2) Dorsal setae distinctly pectinate; cuticle almost colourless, finely granular; d_2 much reduced; h a almost at the same level as sc e; epimeres III and IV united at their internal ends. On squirrels and in their nests. Holland, Germany, Italy, U.S.S.R. (Moscow region).

1. L. sciurinus Koch.

2(1) Dorsal setae almost smooth, with sparse, short pectinations; cuticle pale brown, with a cluster of large, oval, flattened projections on the posterior dorsal region of the idiosoma; d_2 well-developed; h a well posterior to sc; epimeres III and IV free. On the musk rat and in its nest.

2. L. desmanae sp.n.

Hypopi

1(2) Coxal fields III closed (epimeres III united at their ends with epimeres IV), tarsus IV ending in a long macroseta and several short spines; ventral setae of femora I and II very long, flexible and capilliform. Length 350μ. On squirrels. Holland, Germany, Italy, U.S.S.R. (near Moscow).

1. L. sciurinus Koch.

2(1) Coxal fields III open - epimeres III and IV free; ends of tarsus IV without macroseta, ventral setae of femora I and II short; not more than 280μ long. On other mammals.

3(4) External ventral setae of tibiae and genua I and II represented by strong conical spines. Propodosoma much elongated, its lateral edges uniting to form an obtuse angle anteriorly; apical seta of tibiae I and II long, unmodified; posterior angles of the body rounded; clasping organ small in size, with few transverse ridges. On a mole (Mogera robusta Nehr.) found in the extreme east of Korea (Seoul).

5. L. mogerae sp.n.

4(3) Ventral setae of tibiae and genua I and II fine, flexible, or shaped like smooth spines; propodosoma shorter, its edges united anteriorly in an obtuse angle; apical seta of tibiae I and II short, rounded distally; posterior angles of the body acute; clasping organ large with many transverse ridges.

5(6) Body elongated, about 1.5 times longer than wide; its posterior angles forming 2 small conical prolongations, curved ventrally; tarsi IV with a strong conical spine, 3 fine setae of average length and 2 small spine-like setae (in addition to the reduced claw); tarsi I and II with 3 large, lanceolate setae. On musk rat (Desmana moschata L.).

2. L. desmanae sp.n.

6(5) Body wide, rounded or almost rhomboidal, 1.2 to 1.3 times

longer than wide; posterior angles forming a border curved perpendicularly to its surface; end of tarsus IV without spines, with 4 fairly long and 1 short seta; setae of tarsi I and II simple or scarcely enlarged distally.

7(8) A larger species: 220 to 260μ; arists long; posterior clasping organ of average length with about 10 transverse ridges; body rounded, gradually narrowing posteriorly. On moles (Talpa europea L.). Holland, Germany, U.S.S.R. (near Moscow, Leningrad and Smolensk).

3. L. talpae Kram.

8(7) A smaller species: 190 to 210μ; arists very short; posterior clasping organ extremely long, with 15 to 20 small transverse ridges; body almost rhomboidal, narrowing suddenly towards its posterior end. On various species of mice, mole and different rodents. Holland, Germany, U.S.S.R. (near Moscow, Abkhasia, near Jakoutsk).

4. L. soricis Ouds.

1. Labidophorus sciurinus C.L. Koch. (Figs. 64, 65, 577 to 579, 584 to 586.)

C.L. Koch, 1841, No. 7 (Dermaleichus); 1842, Übers. d. Arachn. Syst., III, 121, t. XIII, Fig. 69; Canestrini, 1888a, 377 (Homopus); Haller, 1880, Ztschr. wiss. Zool., XXXIV, 268, t. IX, Figs. 4 to 16; Kramer, 1899, 150; Oudemans, 1910, Entomol. Ber., III, 23; 1915, ibid., IV, 199 (Dermacarus); Michael, 1901, 283, t. XVIII to XIX; Berlese, 1897, 106 (Glycyphagus); Oudemans, 1897, Tijdschr. Entomol., XL, 252 (Labidophorus).

This is a pale, lemon yellow in colour, sometimes with a greenish tinge; the gnathosoma, legs and coxal sternal skeleton a reddish brown. The cuticle is almost colourless; the dorsal surface is covered with fine tubercles, and it is only at the anterior edge of the idiosoma that the cuticle is smooth and more heavily sclerotised. The setae of the dorsal surface

are distinctly pectinate; the pseudostigmatic organ is also pectinate and in shape resembles the pectinate setae of the genus Ctenoglyphus.

♂. The idiosoma is twice as long as its width, with almost parallel lateral edges and a widely rounded posterior end; the "graining" of the cuticle on the ventral surface is much finer than on the dorsal; v a (?) are smooth; v p and d_2 are well-developed and pectinate; sc e are smooth and 2.5 times longer than the pectinate sc i; h a are far behind sc; the approximate lengths of the setae of the idiosoma (in percentages of its length) are: v a and v p 10, sc i 12 to 13, sc e 32, h a 20, h p 27, d_1 22, d_2 7, d_3 and d_4 25 to 27, l_1 13, l_2 and l_3 35 to 38, l_4 and sa e 22, sa i 10.

The legs are proportionately longer and thicker than in the ♀, approximately 48 (I), 45 (II), 42 (III) and 50 (IV) % of the length of the idiosoma. Externally, legs III and IV have a large, leaf-shaped transparent keel, whilst the joints of legs I and II have no protrusions. Praetarsi III and IV are strongly enlarged and are much longer than those of I and II, and considerably longer than in the ♀. Length 370 to 655µ.

♀. The shape and proportions of the idiosoma change with the extent of its dilation with eggs; in young specimens it is approximately 1.5 times longer than its width, and has almost parallel lateral edges, slightly indented in the middle, and a widely rounded posterior edge; in older specimens, which are very much distended with eggs, the idiosoma is only 1.2 times longer than its maximum width (which is now far posterior to its middle), and is almost heart-shaped. The texture of the cuticle on dorsal and ventral surfaces is almost the same; v p and d_2 are microsetae; both pairs of sc are clearly pectinate, sc e being slightly longer than sc i; h a are almost on the same transverse line as sc; p a are arranged as a triangle and p_2 are considerably external to all the others; the approximate lengths of the setae of the idiosoma (in percentages of its length when distended) are: v p 19, sc i 15, sc e and h a 20, h p 24, d_1 15, d_3 25, d_4 20, l_1 13, l_2 26, l_3 20, l_4 22. The genital opening

is very large, extending posteriorly as far as the apical edge of acetabula IV; epimeres III and IV are fused internally, thus closing coxal fields III; the chitinous thickenings around epimeres I and II are very wide.

The legs are much thinner than in the ♂, particularly the posterior ones; their approximate lengths are: 44 (I, II), 43 (III) and 60 (IV) % of the length of the idiosoma; the tarsi have no keels and the praetarsi are the same length, not abnormally long. Length 460 to 920μ.

In the nymphs, the setae of the dorsal surface of the idiosoma have the same structure as in the adults.

Hypopus. This is pale yellow in colour, with a light orange tinge, particularly on the sides of the body; the legs and sucking disc are reddish brown. The body is fairly wide, 1.3 to 1.4 times longer than its width, with an obtuse anterior edge, convex lateral edges and a smoothly rounded posterior end, the latter being slightly concave and having obtusely rounded angles. The propodosomal shield is slightly more than half the length of the hysterosomal; an opisthosomal region is not distinct. The arists are very short and arranged in a straight, transverse row, the external being shorter than the internal and tubular. Epimeres I, which form the anterior bifurcation of the sternum, are half the length of the sternum itself; the ends of epimerites II are separated by a considerable distance from epimeres III; the latter are fused at their ends with epimeres IV, and form with them a continuous ring which closes coxal fields III; from the posterior edge of this ring, a short projection runs internally, connected with a very thin, S-shaped line, and this separates the area surrounding the genital opening from coxal fields IV; the latter are not surrounded by a thickened border. The genital opening is very large, as well as the genital "suckers", whose diameters are equal to the length of genu III. The folds of the sucking disc are large, with sharp, protruding posterior angles, which project beyond the posterior edge of the body; the internal surface of these folds

has numerous, well-sclerotised transverse ridges. The anterior "claspers" are pear-shaped, the posterior ones resemble a spatula and all have 6 thick, widely-separated ridges.

Legs I and II are shorter and more massive than in other species; in length they are 30 (I), 28 (II) % of the length of the body. The setae arising from the trochanters are very long and capilliform; the external setae of the genu and ventral setae of the tibia are relatively short, simple and flexible; the apical dorsal seta of the tibia has a blunted end, is shaped like a rod and is slightly shorter than the tibia; the tarsi are much shorter than the tibia and have 3 slightly lanceolate setae; the sensory rod is slender and is placed near the middle of the tarsus; beta is feebly-developed. Legs III are about 23% of the length of the body, they are fairly slender and their tarsi are equal in length to the tibia and have 3 narrowly lanceolate setae; the ventral setae of the tibia and genu are thin and flexible; the apical dorsal seta of the tibia is thin, long and pointed. Claws I to III are fairly long, slender and slightly bent. Legs IV are equal in length to III; their tarsi are shorter than the tibiae and distally each has a very large keel-shaped seta (exceeding half the length of the body), another equal to half the length of the body, 3 fairly large slender spines and 4 small setae; a claw is absent; the setae of the basal segments have the same structure as those of legs III. Length 250 to 350μ.

(The British specimens of L. sciurinus described by Michael 1901 are much smaller than the German or Russian ones; they may belong to a different race.)

Distribution. Holland, Italy, Germany, U.S.S.R. (in the Moscow region).

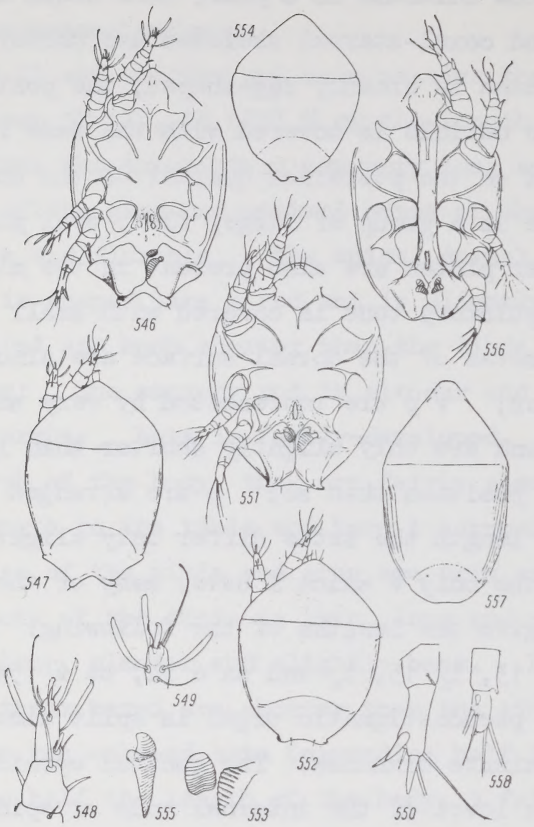
Ecology. It lives in squirrels' nests (Sciurinus vulgaris L.) and the hypopi are often found in large numbers on the animal itself. The nymphs and adults feed on microscopic Algae (Protoccaceae and Palmellaceae); probably they scrape it from the branches which the squirrels use for building their nests.

2. Labidophorus desmanae sp.n. (Figs. 544 to 550.)

♀. In preparations, the idiosoma is a pale, dull brown in colour; the gnathosoma, legs and coxal-sternal skeleton are darker. In pregnant females, the idiosoma is broadly egg-shaped, the posterior edge slightly concave. The cuticle is covered with the same fine graining as in L. sciurinus, but on the posterior quarter of the dorsal surface (in the mid-line) there is a group of large, flat, oval plates; similar but slightly smaller plates are also present in the middle of the coxal fields; the copulatory tube is covered with small raised chitinous tubercles. The setae of the dorsal surface are almost smooth, with sparse pectinations; v p are represented by very small microsetae; d_2 are well-developed and are only slightly shorter than l_1; h a are much more posterior in position than sc; p are arranged in a slanting longitudinal row. In length the setae differ only slightly from those of L. sciurinus; in the only ♀ which I have, many of the setae were broken and I can only give the lengths of the following: v p 2, sc e 20, h a 17, h p 20, d_2 13, l_1 15, l_4 and sa e 24, sa i 15% of the length of the idiosoma. The pseudostigmatic organ is split almost to the base into 2 irregularly pectinate branches. The genital opening extends posteriorly only up to the level of the internal ends of epimerites II; epimeres III and IV and epimerites III are free; coxal fields III are fairly wide open.

The legs are slightly shorter than in L. sciurinus and have the following lengths: 40 (I), 38 to 39 (II, III) and 46 (IV) % of the length of the idiosoma; the ventral setae of the tibia and genu III and tibia IV resemble pointed spines. Length 688μ.

Hypopus. This is pale yellow in colour, the legs and sucking disc hardly darker than the rest of the body. The body is 1.4 to 1.5 times longer than its width, with an obtusely-angled anterior and strongly concave posterior edge; the lateral edges are slightly convex and almost parallel with each other from the level of the scapular region to the sharply protruding angles of the opisthosomal region; here they bend sharply and



Figs.546 - 558. Hypopi of the genus Labidophorus.

Fig.546 - Labidophorus desmanae, sp.n., ventral surface. Fig.547 - Ditto, dorsal surface. Fig.548 - L. desmanae, sp.n., tibia and tarsus I, dorsal surface. Fig.549 - L. desmanae, sp.n., end of tarsus I, ventral surface. Fig.550 - L. desmanae, sp.n., tarsus IV, dorsal surface. Fig.551 - L. talpae Kram., ♀, ventral surface. Fig.552 - Ditto, dorsal surface. Fig.553 - L. talpae Kram. Left clasp of the clasping apparatus. Fig.554 - L. soricis Ouds., dorsal surface. Fig.555 - L. soricis Ouds., Right clasp of the clasping apparatus. Fig.556 - L. mogerae, sp.n., ventral surface. Fig.557 - L. mogerae, sp.n., dorsal surface. Fig.558 - L. mogerae, sp.n., tarsus IV, dorsal surface.

converge at a right angle towards the posterior angles of the body; the latter are strongly sclerotised and project like blunt cylindrical "horns", which are slightly bent ventrally; sa i arise from the ends of these "horns". The propodosomal shield is half the length of the hysterosoma; the opisthosomal region is very clearly defined, with a semicircular anterior edge. The arists are short and arranged in a rectangular shape. The sternum is well-developed; the ends of epimerites II almost touch epimeres III, which are free and separated by a wide space from epimeres IV; the latter are fused with the thickened edges of coxal fields IV, forming a closed "frame". The genital opening and "suckers" are small; the folds of the sucking disc have obtuse angles, which do not protrude at all beyond the body, their ridged internal surfaces are feebly developed; the anterior claspers are oval and slanting, with approximately 10 transverse ridges, the posterior are shaped like wedges, and have 14 to 15 ridges.

Legs I and II are fairly short; the setae of the trochanters are short, whilst the ventral setae of the tibia and the basal seta of the genu are thickened and resemble spines; the apical dorsal seta of the tibia is rod-shaped, blunted at the end and equal in length to the tibia. The tarsi are noticeably longer than the tibia, with 3 flattened narrow lanceolate setae. Legs III are equal in length to legs II and are fairly slender; their tarsi have 3 setae, similar in appearance to those on tarsi I and II; the ventral setae of the tibia and genu resemble pointed spines; the dorsal seta of the tibia is short, slightly expanded distally. Legs IV are slightly longer than legs III, their tarsi are almost twice as long as the tibiae and noticeably widened distally; their ends bear large finger-shaped spines, a reduced claw and 3 moderately long thin setae and 2 small spine-shaped setae. Length 250 to 270μ, width 170 to 180μ.

Distribution. This probably corresponds with that of the musk rat. (This description is from a specimen which was not labelled).

Ecology. It lives in the nest of the musk rat (Desmana moschata L.).

All the material used in this description was obtained from the residue in jars containing spirit material of the musk rat; the ♀ and 2 hypopi have been described by Professor V.V. Redikorzev, the protonymph and 2 hypopi by E.M. Bulanova.

3. Labidophorus talpae Kram. (Figs. 551 to 553.)

Kramer, 1877, Arch. Naturg., XLIII, 1: 249, t. XVI, Figs. 1 to 3; Oudemans, 1915, Entomol. Ber., IV, 198 (Labidophorus); Berlese, 1897, 106; Kramer, 1899, 145 (Glycyphagus).

This is known only as the hypopus. It is pale yellow in colour, the legs and sucking apparatus being the same colour as the rest of the body. This is 1.2 to 1.3 times its width, widely egg-shaped, with an obtuse-angled anterior edge, strongly protruding lateral and a slightly concave posterior edge, which is outlined with a sharply-bent lamellate border. The propodosomal shield is slightly more than half the length of the hysterosoma and half its width at the base; the opisthosomal plate is well-defined, with smooth lateral angles; that part of the hysterosoma anterior to the opisthosomal plate is less than twice its length. The arists are arranged in a transverse row, they are very long and capilliform. The sternum is well-developed; the ends of epimerites II touch the free epimeres III, and epimeres and epimerites IV are fused at their internal ends, so that coxal fields IV are closed. The folds of the sucking apparatus have reflected posterior angles, slightly concave anterior internal edges and a finely ridged internal surface; the anterior claspers are oval, with truncate ends, they are large and have approximately 12 thin, transverse ridges, the posterior are broad, shaped like wedges, with a rounded end, covered with 9 to 11 more sparsely placed ridges. The genital opening is small, with moderately large suckers.

Legs I and II are fairly short and massive, approximately equal to 33 (I), 30 (II) % of the length of the body; the ventral setae of the tibia and the anterior setae of the genu are long and thin; the apical

seta of the tibia is very short (almost half the length of the tibia), shaped like a blunt-ended rod; the tarsi are noticeably shorter than the tibia, with 4 long setae with thickened ends; the sensory rod is short, fairly massive, placed in the proximal third of the tarsus. Legs III are slightly shorter than legs II and more slender; the tibiae have no teeth, but a long, flexible ventral seta, and a rather long distally thickened apical one; the tarsi are barely longer than the tibia, with 5 large, simple setae and 1 ventral lanceolate spine. Legs IV are noticeably shorter than legs III; the ventral seta of the tibia is short and round; the tarsi are noticeably longer than the tibia, massive, with 4 long setae (1 equal to the entire length of the leg), 2 smaller setae, and a completely reduced claw. Length 225 to 260μ, width 175 to 260μ.

Distribution. It has only been recorded from Germany, Holland, U.S.S.R. (near Moscow, Leningrad and Smolensk).

Ecology. It was found on the mole (Talpa europea L.), black rat (Rattus rattus L.) and on the dormouse (Muscardinus avellanarius L.).

4. Labidophorus soricis (Figs. 554, 555.)

Oudemans, 1915, Entomol. Ber., IV, 198.

Hypopus. This is morphologically allied to L. talpae Kram., but is considerably smaller, with a non-pigmented body, which is more rhomboid in shape; the hysterosoma is much shorter (only 1.55 to 1.6 times longer than the propodosoma) and narrows more sharply towards the posterior end; its lateral edges are feebly convex in the scapular region, becoming almost straight towards the end of the body; in the region between the more clearly-defined anterior edges of the opisthosoma and the posterior end of the body, they are more or less clearly concave; the recurved lamellate edge has a sharper outline. The arists are very short. The ends of epimeres I usually touch one another for a considerable distance in the mid-line of the body, but they do not form a distinct sternum.

The internal edges of the folds of the clasping apparatus are dented anteriorly; the anterior claspers are smaller than in the previous species, whilst the posterior ones are much longer, very narrow, and with approximately 20 thin, transverse ridges. The legs, particularly the posterior ones, are longer than in L. talpae: 38 (I), 35 (II), 36 (III) and 38 (IV) % of the length of the body; the chaetotaxy of the legs is the same as that of L. talpae. Length 170 to 210μ, width 130 to 160μ.

Distribution. Holland, Germany, U.S.S.R. I have found it in various places around Moscow and in the Orlov region, Abhaz and near Yakutsk.

Ecology. It is found mainly on various species of field mice: Sorex araneus L., S. minutus L., Neomys fodiens L., also on the mole and many other species of rodents (Arvicola amphibius L., Microtus oeconomus Pall, Evotomys glareolus Schr., Micromys minutus L.).

5. Labidophorus mogerae sp.n. (Figs. 556 to 558.)

This is only known as the hypopus. It is pale yellow in colour, with an elongated body, 1.5 to 1.7 times longer than its width, and much narrower than in other species; the anterior lateral edges of the propodosoma converge anteriorly at an acute angle, which has a blunt end; the lateral edges of the hysterosoma are almost parallel to each other over a great distance, then they are slightly rounded and merge with the posterior edge, which is slightly concave in the middle; the posterior angles of the body are smooth. The propodosomal shield is 1.6 times shorter than the hysterosomal, at its base it is 1.5 times wider than its length; the opisthosomal region is not clearly outlined and has indistinct lateral angles. The arists are short and arranged in a transverse row. The sternum is normal in appearance. A wide depression runs along the middle of the ventral surface of the body, its lateral walls supported by the reflected ends of epimeres II and III, epimerites II, the ends of epimeres IV and the strongly-developed epimerites IV which are longitudinal

in position; coxal fields III and IV are partially open. The genital opening is relatively small, with barely perceptible suckers. The folds of the clasping apparatus are smaller than in other species of the genus Labidophorus, each having 5 widely separated, much raised transverse ridges; of these the anterior ones are rectangular in shape, with smooth angles, the posterior are more triangular.

Legs I and II are fairly short and massive; the external ventral seta of the tibia and the external seta of the genu are modified to form strong, slightly pectinate spines; the apical seta of the tibia is long flexible and slightly expanded distally; the tarsi are slender, slightly longer than the tibiae, with 4 long setae, which are slightly bent and resemble hooks; the sensory rod is straight, thin, placed in the proximal part of the tarsus. Beta resembles a spine. Legs III are very slender; the tibia, at its distal end, has a conical process and a fairly long, non-modified dorsal seta; the tarsus has 4 fairly large, flattened (almost sword-shaped) setae and a reduced claw. Legs IV are equal in length to legs III, but more massive (the trochanter and femur are particularly thick); the tibia has the same process as tibia III, and a much reduced apical seta; the tarsus is shorter than the tibia; dorsally it bears a thick bent seta and terminates in a reduced claw and 5 setae, the latter become broader towards the proximal end, and one of them is equal in length to the whole leg. Length 255 to 270μ, width 150 to 180μ.

Distribution. It was described from material collected in Korea (near Seoul). The hypopus was found on the far east mole - Mogera robusta Nehr.

11. Genus Gohieria Ouds.

Oudemans, 1939, Zool. Anz., CXXVII, 185. - Ferminia Oudemans, 1928, Entomol. Ber., VII, 347; Bulanova, 1937, Bull. Soc. Nat. Moscou, XLVI, 304 (Ferminia).

Type species: Glycyphagus fuscus Ouds. 1902.

Sexual dimorphism is slight. The gnathosoma is medium in size, almost completely concealed from above by the rostrum; the idiosoma in both sexes is elliptical, narrower in the ♂ than in the ♀, with an indefinite (owing to its delicate structure) curved rostrum and a widely rounded posterior edge, devoid of lobes; the flat, wide edges of acetabula I to III protrude slightly at the sides of the body, giving them a serrated outline. The cuticle is strongly sclerotised, smooth (finely pitted) and dark brown in colour; on the coxal fields it is thicker and covered by a more coarsely-pitted sculpturing; along the edge of the idiosoma there is a very narrow strip of membranous cuticle, which separates the dorsal and ventral shields and can be well seen in lateral view. V a and v p are well-developed; there are 3 pairs of scapular and lateral setae; d_2 are considerably anterior to d_3; all the setae of the dorsal surface of the idiosoma are short, smooth and fairly flexible; on the anterior half of the idiosoma, they are normally directed anteriorly; on the posterior half, they point laterally and backwards; p a are finely pectinate.

The legs are long, the anterior ones in both sexes being fairly massive; all the femora, genua and tibiae are sharply angular, with numerous obtuse longitudinal ridges; on legs I and II, in addition, the distal edges are widened like funnels; femora I and II are shaped like goblets, narrowing considerably towards the base and with a transverse keel, which separates the narrow proximal part from the widened distal one (in the ♀ the sculpturing on the legs is still more emphasised than in the ♂); the setae of the legs are thickly pectinate and the ventral seta of tibia IV is well-developed.

♂. All the coxal fields are completely and strongly sclerotised and form a continuous sternum, resembling that found in many Hydracarina; the only unthickened region is that in the middle of the body between the internal ends of the epimeres; the sternum is well-developed and free; epimeres II to IV are joined internally; epimerites IV are absent. The genital opening is placed between the bases of legs IV; when

at rest, the apex of the penis is directed posteriorly; the anal slit is long, its folds protruding slightly beyond the back edge of the body. The legs are without any of the protrusions characteristic of the ♂; the praetarsi are not enlarged. Legs III and IV are noticeably thickened and bent, with modified tarsi.

♀. Epimeres I are completely fused with the epigynium, forming a massive transverse plate, in front of the genital opening; epimeres II to IV are free, but their internal ends touch an oval sclerotised ring, which surrounds the genital opening; the latter is very large and occupies the whole region between the bases of legs II to IV; half the surface of coxal fields I and II and all of III and IV are strongly sclerotised. The genital "suckers" are very small and the copulatory tube is absent; the anal slit extends to the posterior end of the body and even protrudes beyond it; there are well-developed genital tracheae.

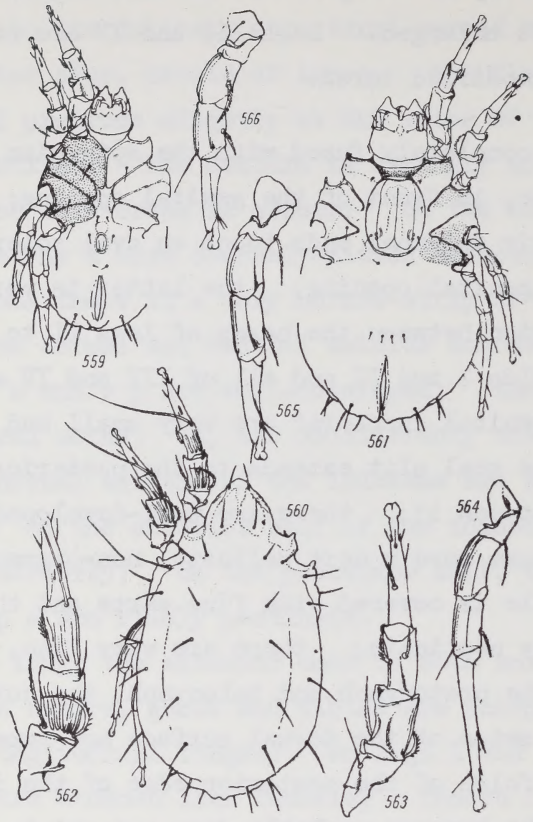
The nymphal stages have a more delicate, non-pigmented cuticle; in the larva, the cuticle is covered with fine warts and the setae of the idiosoma are slightly pectinate; there are very fine, nipple-shaped "brustsẗide". In the protonymph and telonymph, the cuticle resembles crocodile skin, the setae of the dorsal surface are somewhat flattened and smooth, and the folds of the posterior edge of the idiosoma are clearly defined. The hypopus probably does not exist. The genus is monotypical.

Gohieria fusca Ouds. (Figs. 559 to 566.)

Oudemans, 1902, Entomol. Ber., A: 21; 1903, Tijdschr. Entomol., XLVI, 15, t. II, Figs. 31, 32, et t. III, Figs. 33 to 37 (Glycyphagus); 1928, 347; Bulanova, 1937, Bull. Soc. Nat. Moscou, XLI, 304 (Ferminia).

Biology: Bulanova, 1937.

A uniform, pinkish-brown in colour. The setae of the dorsal surface are practically the same lengths, and fluctuate from 5 to 16% of the



Figs.559 - 566. Gohieria fusca Ouds. (after Bulnhova).

Fig.559 - ♂ , ventral surface. Fig.560 - ♀, ventral surface. Fig. 561 - Ditto, ventral surface. Fig.562 - Leg I, ♀, dorsal surface. Fig.563 - Ditto, ventral surface. Fig.564 - Leg IV, ♀. Fig.565 - Leg III, ♂ . Fig.566 - Leg IV, ♂ .

length of the idiosoma; v a, sc i, d_1, d_2 and sa i are shorter than the others (5 to 6%); sc e is 1.6 to twice as long as sc i, approximately the same length as h a, h p, d_3, d_4 (8 to 11%); l_2 to l_4 and sa e are longer, 12 to 16% of the length of the idiosoma. The ventral setae of femur I are smooth, of femora II to IV - finely pectinate; the basal setae of genua I and II are serrated, the internal one bent in a graceful curve, the external almost straight; the ventral setae of the tibia and the middle ventral seta of tarsi I and II are fairly short, thick and pectinate. In the ♂, the legs are noticeably longer and more massive than in the ♀, their approximate lengths are 52 (I), 50 (II), 40 to 41 (III), 49 to 50 (IV) % of the length of the idiosoma; tarsi III and IV are barely longer than the tibia; the lengths of the legs in the ♀ are approximately 42 to 43 (I), 35 to 37 (II, III), 41 to 42 (IV) %; tarsi III are almost twice, and tarsi IV 2 to 2.3 times longer than the corresponding tibia. Length of the ♂ 300 to 320μ, width 180 to 200μ; length of the ♀ 386 to 412μ, width 240 to 260μ.

Distribution. Holland, France, England, U.S.S.R., where it was found in Moscow and some places in the Ivanovsk region (Mozdok, Baku), Central Asia (Tashkent, the Fergan valley: Pahtalik-Kul) and in Western Siberia (Barnaoul).

Ecology. A synantropic species living mainly in flour, but also in wheat and rice; up to now, it has not been found in the field. In the southern region of the U.S.S.R. (in Central Asia, near the Caucasus) it is sometimes found in large numbers, causing perceptible damage to food products; in other regions, it only occurs sporadically.

12. Genus Xenoryctes gen.n.

Type species: Glycyphagus krameri Michael 1886.

Sexual dimorphism is pronounced. The idiosoma is considerably flat-

tened dorso-ventrally, with a well-developed, curved rostrum, and an unlobed body. The cuticle is very thick, hard, dark brown and covered with large pits; the rostrum has a pair of S-shaped, longitudinal bends and, as in Gohieria, a feebly cuticularised line encircles the idiosoma and is well seen from the side. V a are well-developed and thickened like horns, v p are absent, and all the other setae of the idiosoma are very small, smooth, thick microsetae, the majority of which are difficult to distinguish (the peripheral ones: h a, l_2, l_3 and sa i are easier to see).

The legs are fairly long, relatively slender and with varying lamellate protrusions; the apical seta of the tibia arises from the tubular end of a keel-shaped protuberance; the setae of the femur, genu and tibia (except the apical one) are pectinate, serrated or modified in some other way. The apical seta of tibia IV is absent.

♂. The idiosoma is elliptical, with almost parallel lateral edges and a widely rounded posterior edge. The sternum, epimeres II, IV and epimerites II are joined at their ends with a massive sclerotised semicircle placed in the centre of the body, slightly anterior to the genital opening; epimeres III are reduced or absent; epimerites IV are well-developed and free. The genital opening is placed between the bases of legs IV and, when at rest, the penis is directed anteriorly; the anal slit is very small, displaced away from the posterior edge of the idiosoma and surrounded with a sclerotised ring. Legs I and II are strongly thickened, with leaf-shaped transverse keels on tarsi I and II and tibia I; serrated ventral plates are also present on tibiae I and II and femur I; tibiae I and II have no ventral setae. Legs III and IV are slightly bent, and the ventral seta of tibia and genu III is modified; tarsi IV have the same plate-shaped keel on their ventral surfaces as tarsi I; the praetarsi are not enlarged.

♀. The idiosoma is broadened posteriorly and has a somewhat deeply incised, almost heart-shaped posterior edge. The sternum is well-developed

and long, fused at its end with the epigynium or with a special sclerotised crescentic ring, placed anterior to the genital opening; the ends of epimeres II, III, and sometimes IV as well, are also joined to the epigynium or to the above-mentioned ring; this, in its turn, is also joined to a massive circumgenital ring; the anal slit is surrounded by a strong, sclerotised frame. The legs are more slender than in the ♂, with more or less well-developed keels on the dorsal side of the tibia. There are no plate-shaped formations on the ventral surfaces of tibia and genu; the setae of legs III are not modified and tibia IV has no ventral seta.

Hypopus. The body is egg-shaped or oval, with a noticeably convex dorsal surface; there is no separate opisthosomal region. The coxal-sternal skeleton is weakly developed; epimeres III are joined at their ends with epimeres IV, thus closing coxal fields III. The anterior claspers of the fixing apparatus are rounded, with more or less radial ridges, the posterior are narrow and well-removed from the anterior ones, with 5 to 7 transverse ridges. The legs are fairly long and slender, the apical seta of tibia I and II is long and normal in structure, the tarsi are long, straight and cylindrical, with the distal setae arranged in varying ways; tarsi IV have no keel-shaped setae and may have a well-developed claw.

The genus Xenoryctes contains 2 species, which have only been found in Europe and are biologically connected with Insectivores.

Xenoryctes gen.n.

Females

1(2) Ends of sternum and epimeres II and III joined to a slender chitinous arc in front of the circumgenital ring, the latter is also joined to the same arc; epimeres IV free; tibia I with a feebly developed dorsal keel and only 1 smooth, ventral seta. England, Italy.

1. X. krameri Mich.

2(1) Ends of sternum and of epimeres II to IV directly joined to a well-sclerotised epigynium, which is itself joined to the circumgenital ring; tibia I with a well-developed dorsal keel and 2 ventral setae, of which 1 is smooth and the other pectinate. Holland, U.S.S.R. (Moscow).

2. X. heptneri sp.n.

Hypopi

1(2) Rostrum very narrow, strongly projecting forwards; the ends of the folds of the clasping apparatus are produced posteriorly like small pointed "horns"; posterior edge of idiosoma strongly concave; legs III and IV slightly shorter than I and II; tarsus IV with no claw, but 4 long distal setae. England, Italy.

1. X. krameri Mich.

2(1) Rostrum rounded, only slightly projecting forwards; the ends of the folds of the clasping apparatus blunt, not visible from above; posterior edge of idiosoma almost straight; legs III and IV much shorter than the anterior ones, tarsus IV with a well-developed claw and with only 1 long seta. Holland, U.S.S.R.

2. X. heptneri sp.n.

1. Xenoryctes krameri Mich. (Figs. 528 to 539.)

Michael, 1886, Journ. R. Micr. Soc., Ser. II, vol. VI, 377, t. X; 1901, 275, t. XVI to XVII, Figs. 5 to 11 (Glycyphagus). - talpae Canestrini, 1888, 18, t. II, Figs. 12 to 14; 1888a, 379, t. XXXV, Fig. 3 (Homopus); Berlese, 1897, 106; Kramer, 1899, 145 (Glycyphagus).

♂. A dark, reddish-brown in colour. The idiosoma is twice as long as its maximum width, which lies above the base of legs III; when alive, it appears flattened, although feebly convex, with slightly reflected edges; the rostrum is one-sixth the total length of the idiosoma, with

lateral edges which are more parallel than in the ♀, since the dorsal keels do not diverge so strongly at the posterior end. The cuticle is finely pitted, and on the dorsal surface there are usually several irregular raised ridges.

The legs are more massive than in the ♀, genu I being strongly thickened and much longer than the tibia; ventrally, they have no lamellate formations and the dorsal setae are either reduced or absent; tibiae I, on their ventral surfaces, each have a transparent lobe, whose distal edge is divided into 7 to 9 thin, diverging spikes; dorsally they have a long tubular protrusion, bearing an apical seta; on its dorsal surface, tarsus I has a leaf-shaped transparent keel, which is much raised at its proximal end and gradually tapers off for the distal two-thirds of its length; ventrally, a similar keel is present, but it is rather more distal in position. The chaetotaxy of legs II resembles that of legs I, but differs in the ventral surface of the genu having 2 toothed lobes, of which the proximal one is smaller, semicircular in shape, and thickened at the base, whilst the distal one is longer and hatchet shaped; on its dorsal surface, tibia II is produced into a 1 amellate keel; the leaf-shaped keels of the tarsus are more proximal and more even in width; the internal basal seta of the genu is better developed and is pectinate. Legs III have no leaf-shaped extension and the ventral seta of the genu is expanded distally; the ventral seta of the tibia has very long pectinations and 4 to 5 widely separated protrusions. Tarsus IV has a lamellate keel on its ventral side. Length about 250μ, width 130μ.

♀. This is slightly lighter in colour than the ♂; the idiosoma is approximately 1.6 times longer than its maximum width, which is considerably posterior to the base of legs IV; the dorsal surface is more complicated in structure than in the ♂. The cuticle is more coarsely grained. The rostrum is about one-fifth the total length of the idiosoma, its lateral edges and longitudinal ridges diverge more posteriorly. The ends of the sternum and epimeres II and III are joined with a thin sclerotised crescen-

tic ring, which is anterior to the circumgenital ring, and this crescentic ring is itself joined to the circumgenital ring; the latter is transversely elliptical, noticeably wider than its length; epimeres IV are free.

The legs are much more slender than in the ♂, their lengths being approximately 37 (I), 34 to 35 (II, III) and 43 (IV) % of the length of the idiosoma; genua I and II are noticeably widened distally, slightly swollen and evidently without lateral keels; the dorsal and lateral keels of the tibia are feebly developed; the basal setae of genu I, like that of genu II, are thick, fairly short and distinctly toothed in the distal half, where the barbs are longer and more widely spaced; tibiae I and II have a smooth seta, external and ventral in position; the setae of the tarsi are fairly long. Length about 350μ, width 240μ.

Telonymph. This is whitish and translucent. The propodosoma is fairly clearly separated from the hysterosoma by a transverse groove; on its surface are 16 small, widely spaced regions arranged as follows: an unpaired circular region is behind v a and posterior to this are 2 almost triangular, fairly large areas; behind these again are 5 smaller regions, the external ones being much larger than the 3 internal ones; along the transverse groove are 8 more, the external lateral pair being more elongated than the others; the pair following these are much smaller and the 2 ventral ones are very small; analagous regions on the hysterosoma are small, irregular in shape and divided into wide regions by soft folds. V a are irregular in shape and blunted terminally; sa e are well-developed and the same length as sa i, but shorter than l_3.

Hypopus. This is yellow-white, the legs and clasping apparatus reddish. The body is broadly oval, with a very narrow and strongly projecting rostrum and a deeply concave posterior edge, beyond this project the ends of the folds of the clasping apparatus, which are shaped like sharp horns. The anterior claspers are fairly large, with 5 sharply divering ribs; the posterior claspers are elongated, not narrowed at the base, with 7 transverse

ribs. The legs are very slender, particularly the posterior ones; the apical setae of the tarsi are longer, tarsus IV has no claws, but 2 short, thick setae, with their ends turned upwards, and 4 long ones. Length about 250μ.

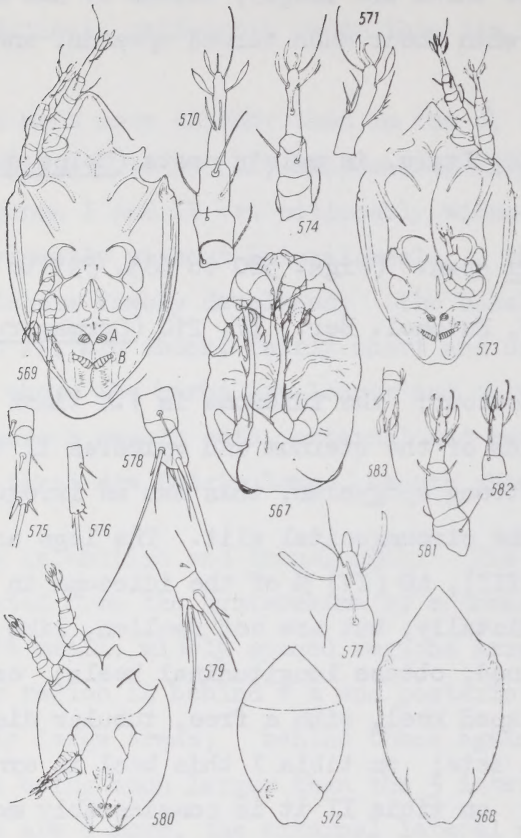
Distribution. England, Italy, in mole's nests (Talpa europea L.).

2. Xenoryctes heptneri sp.n. (Figs. 580 to 583, 593 to 595.)

Krameri Oudemans, 1915, Entomol. Ber., IV, 210 (Dermacarus)(non Michael).

♀. Reddish-brown in colour; the idiosoma is 1.4 times longer than its maximum width; the ends of the sternum and epimeres II to IV are joined directly with a very strong epigynium, this has an irregular outline and encircles anteriorly the circumgenital slit. The legs are very slender, 35 (I), 30 to 32 (II, III), 40 (IV) % of the idiosoma in length; genua I and II widen sharply distally, but are not swollen, like all the tibiae they have clearly defined, obtuse longitudinal keels; each of the tibiae has a vertical leaf-shaped keel, with a free, tubular distal end from which arises an apical seta; on tibia I this keel is exceptionally high and is hatchet-shaped; on tibia II it is considerably more proximal, and on the posterior tibiae, even more so; tibia II has 2 ventral setae: an external, smooth, and a thick, pectinate internal one. Length 330 to 340μ, width 250μ. ♂ is unknown.

Telonymph. This differs from the corresponding stage of X. krameri (which it generally resembles) in the following characters: almost the whole of the dorsal surface of the propodosoma is covered by 1 large, smooth shield; behind this and close together are 2 rows, each consisting of 4 areas of modified cuticle; the anterior row consists of 2 oval external areas and 2 large, membranous ones; the internal pair of areas of the second row have a similar shape. The areas of the hysterosoma are larger than in X. krameri, with a more regular round or oval shape, separated from one another by narrower membranous spaces. V a is regular and



Figs.567 - 583

Fig.567 - Xenocastor fedjushini, sp.n., larva. Fig.568 - Myacarus hypudaei Koch, hypopus, dorsal surface. Fig.569 - Ditto, ventral surface. Fig.570 - M. hypudaei Koch., hypopus, leg I, dorsal view. Fig.571 - Ditto, tarsus I, lateral surface. Fig.572 - M. arvicolae Duj., hypopus, dorsal surface. Fig.573 - Ditto, ventral surface. Fig.574 - M. arvicolae Duj., hypopus, leg I, ventral surface. Figs.575, 576 - M. arvicolae Duj., hypopus, variations in chaetotaxy of tarsus IV. Fig.577 - Labidophorus sciurinus C.L. Koch, hypopus, tibia and tarsus I, dorsal surface. Fig.578 - L. sciurinus C.L. Koch, hypopus, tarsus IV, ventral surface. Fig.579 - Ditto, dorsal surface. Fig.580 - Xenoryctes heptneri, sp.n., hypopus, ventral surface. Fig.581 - X. heptneri, sp.n., leg I, ventral surface, hypopus. Fig.582 - X. heptneri, sp.n., hypopus, tibia and tarsus I, dorsal surface. Fig.583 - X. heptneri, sp.n., hypopus, tarsus IV.

lanceolate; sa e are equal to l_3 in length and sa i are absent.

Hypopus. This is whitish, with non-pigmented extremities and a yellow sucking disc. The body is more regular than in the hypopus of X. krameri, egg-shaped, with a widely rounded, non-projecting rostrum and a slightly indented posterior edge. The folds of the clasping apparatus have obtuse ends, which do not project beyond the posterior edge of the body; the anterior claspers are small, with feebly diverging ribs, the posterior are shaped like spatulae, narrowing considerably towards the base and with 5 to 6 transverse ribs. The legs, particularly the posterior ones, are much shorter than in X. krameri. Tarsi I to III each have 3 larger and 2 smaller leaf-shaped setae, and 2 short simple ones (of which the external one is button-shaped at the end); tarsus IV has a large claw, as well-developed as those on the anterior legs; distally, it has 2 small lanceolate setae and 1 fairly long simple seta. Length 205 to 235μ, width 130 to 155μ.

Distribution. It has been recorded from Holland, the Moscow region (the villages of Shulgino and Kunzevo) and also from the Mojaisk regions.

Ecology. Females, nymphs and hypopi were found by me in the summer of 1936 in a mouse hole, together with G. ornatus Kramer, Fusacarus laminipes Mich. and hypopi of Myacarus arvicolae Duj.; 1 specimen of the hypopus was found by filtering spirit from a jar containing moles.

Genus Orycteroxenus gen.n.

Type species: Glycyphagus dispar Mich. 1886.

Sexual dimorphism is so pronounced, that there is practically no resemblance between ♂ and ♀.

♂. Minute in size (total length of the body 170μ) and superficially resembling a hypopus. The idiosoma is flattened, with exceptionally well-

defined shoulders, almost parallel sides and a widely rounded posterior edge; the rostrum is smooth, strongly sclerotised, with a thin transverse suture in front of the middle, and it covers the whole of the gnathosoma. The rest of the surface of the idiosoma is thickly covered with semi-spherical warts, its cuticle is less dense and feebly pigmented. The setae of the idiosoma are represented by short thick spines. Epimeres I and II are feebly developed, and united at their ends with a horseshoe-shaped epiandrium; epimeres III, IV and epimerites IV are completely absent. The genital opening is slightly behind the base of leg II; the penis is short and, in a state of rest, is directed with its apex towards the posterior end of the body. The anus is very small, surrounded by a thin, sclerotised ring, and remote from the posterior end of the body.

Legs I and II occupy a normal position, they are fairly thick, with goblet-shaped femora and no lamellate outgrowths; legs III and IV are slightly more slender, with tibiae which are expanded distally and narrow towards the base; these legs are almost on a level with one another and form a curved transverse row (the bases of legs III are displaced externally, legs IV anteriorly and internally); they are completely hidden beneath the idiosoma. (Judging from the position of legs III and IV and their structure, it seems likely that they have lost their locomotory function and serve to clasp the ♀ during coition.)

♀. This is considerably larger than the ♂ and closely resembles the ♀ of Talpacarus. The idiosoma is somewhat flattened dorso-ventrally with a sharply defined rostrum, it is broadened posteriorly, the posterior edge having angular corners and a concave middle region; the lateral edges are irregularly excised. The cuticle of the rostrum is strongly sclerotised and smooth, whilst the rest of the idiosoma is covered with spiny warts, resembling those of Talpacarus. V a are absent and v p well-developed and straight; sc e, both pairs of humerals and all 3 pairs of laterals are marginal and inserted on the apices of the idiosomal lobes; they are pointed and rather sharply bent; d_1 and d_4, and

both pairs of sa, are absent (or strongly reduced), so that there are only 2 pairs of setae on the centre region of the idiosoma, which are very close to each other and to the mid-line of the body. The ends of epimeres I and II and epimerites II are joined with a massive sclerotised ring which surrounds the genital opening; epimeres III and IV are very short and free. The copulatory tube is well-developed and conical in shape; the anal slit is far removed from the posterior edge of the body and is surrounded by a thick sclerotised ring. The legs are long, thin and devoid of any keels or protrusions; the genua and femora I and II are slightly expanded distally; the ventral seta of tibia IV is absent. Nymphal stages have not been described and the hypopus is absent, Only 1 species is known.

1. Orycteroxenus dispar Mich. (Figs. 587, 590.)

Michael, 1886, Journ. Linn. Soc. London, 19: 280, t. 35, Figs. 6 to 17; Berlese, 1897, 106; Kramer, 1899, 145; Michael, 1901, 271, t. 15 (Glycyphagus).

♂. A dull grey in colour, sometimes with a definite reddish tinge. The idiosoma is 1.3 times longer than its width; all the setae of its dorsal surface are the same length (3 to 5% of the length of the idiosoma) and resemble spines. The legs are about 40 (I, II), 35 (IV) % of the length of the idiosoma; tibiae I and II are short, 1.5 times shorter than the expanded genu and almost 2.5 times shorter than the tarsi; tibiae III and IV are cylindrical, almost equal in length to the genu and only slightly shorter than the tarsus; the ventral apical spines of tarsi III are close to each other, on tarsi IV they are far away from each other; the praetarsi are shorter and wider than in the ♀. Length about 170μ, width 130μ.

♀. In life it is reddish-brown in colour. The idiosoma is 1.4 times longer than its maximum width, which is well behind the mid-line; when alive, the flattened lateral folds are separated by deep indentations from

the slightly convex distal part of the dorsal surface; the middle region of the latter has an anteriorly rounded transverse swelling, which arises at a considerable distance from the base of the rostrum and extends over the whole of the posterior edge of the idiosoma (thus giving it a raised effect). V p are about 30% of the length of the idiosoma, straight and directed anteriorly, like the slightly longer sc i; sc e are barely longer than sc i, almost straight, directed horizontally towards the sides and slightly towards the posterior edge; h a are about 20% of the length of the idiosoma, sharply bent into an S-shape and also directed laterally and posteriorly; the arc-shaped h p, l_1, l_2 and l_3 point in the same direction and are 20 to 25% of the length of the idiosoma. The legs are approximately 48 (I, II), 43 (III), 52 (IV) % of the length of the idiosoma; tibiae I and II are slightly shorter than the genua; tarsi I and III are approximately twice, tarsus IV 2.5 times longer than the corresponding tibia. Length 350µ, width 240µ.

Distribution. It has only been recorded from England. According to Michael, it is found in moles' nests, in the fresh nests inhabited by the mole at that time; it is never found on the mole itself.

Genus Talpacarus gen.n.

Type species: Glycyphagus platygaster Mich. 1886.

The morphological differences between the two sexes are not very great.

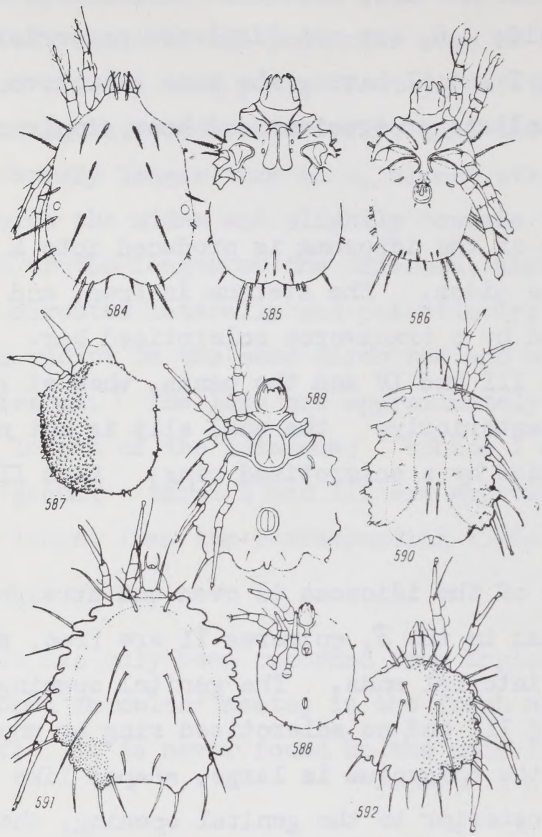
The idiosoma is slightly flattened dorso-ventrally, widely egg-shaped in the ♀ and almost round in the ♂ it has a sharply-defined rostrum and its lateral edges are thrown into flattened, irregular and serrated lobes. The rostral cuticle is strongly sclerotised and smooth, the remaining surface of the idiosoma is covered with feebly pigmented cuticle and small spines. V a are well-developed, slightly bent, and shorter than v p; 3 pairs of

humeral and lateral setae are present; all the setae of the dorsal surface are smooth, needle-shaped and fairly long; sc e, h a, h p, l_1 to l_3 and sa e (also sa i in the ♂) are marginal and inserted on the apex of each lateral fold; d_2 are not displaced posteriorly. The legs are very long and thin, I and II having the same structure in both sexes; they lack keels and lamellate protrusions and bear simple or slightly serrated setae.

♂. The posterior edge of the idiosoma is produced into 4 rounded lobes, longer than those of the sides. The sternum is free, and the ends of epimeres II to IV joined by a transverse sclerotised bar. The genital opening is between legs III and IV and the penis, when at rest, is placed with its apex pointing anteriorly; the anal slit is not near the end of the body and is surrounded by a sclerotised ring. Legs III and IV are slightly curved.

♀. The posterior edge of the idiosoma is even and straight. The sternum is free, shorter than in the ♂, epimeres II are free, whilst III and IV are joined at their internal ends. The genital opening is between the bases of legs II and III and no sclerotised ring or unpaired posterior valve is present; the epigynium is large, shaped like an arrow and pointed anteriorly; posterior to the genital opening, there is a thin curved sclerite, placed with its convex surface anterior in position. The copulatory tube is large and conical, the anal slit long and extending almost to the end of the body.

In the nymph, the posterior end of the idiosoma forms the same, although rather narrower, protruding lobes, as in the ♂, but the lobes of the lateral edges are less divided; the setae are similar to those of the adult, but shorter; in the larva, the cuticle has a coarser texture than in other stages. As far as is known, the hypopus does not exist. A monotypical genus.



Figs.584 - 592 (after Michael)

Fig.584 - Labidophorus sciurinus C.L. Koch, ♀, dorsal surface. Fig.585 - Ditto, ventral surface. Fig.586 - L. sciurinus C.L. Koch, ♂, ventral surface. Fig.587 - Orycteroxenus dispar Mich., ♂, dorsal surface. Fig.588 - Ditto, ventral surface. Fig.589 - O. dispar Mich., ♀, ventral surface. Fig.590 - Ditto, dorsal surface. Fig.591 - Talpacarus platygaster Mich., ♀, dorsal surface. Fig.592 - T. platygaster Mich., ♂, dorsal surface.

1. Talpacarus platygaster Mich. (Figs. 591 to 592.)

Michael, 1886, Journ. Linn. Soc. Lond., XIX, 275, t. XXXIV to XXXV, Figs. 1 to 5; Berlese, 1897, 106; Kramer, 1899, 145; Michael, 1901, 265, t. XIV, XVII, Figs. 1 to 4 (Glycyphagus).

♂. This is pinkish in colour, darker than the ♀, the rostrum, legs and gnathosoma being pinkish brown. The idiosoma (excluding the rostrum) is almost round. The cuticle has a coarser texture than in the ♀. All the setae of the dorsal surface are almost straight; v p are equal in length to sc i and nearly half as long as h a; sa i are evidently absent; d_4 are marginal, inserted on the apex of the medial protrusion of the posterior edge. The approximate lengths of the setae are v p 17, sc e 24, sc i 17 to 18, h a 30, h p 25, d_1 20 to 21, d_2 25, d_3 45, d_4 17, l_1 and l_2 23 to 24, l_3 16, sa e 25. The legs are very long: 62 (I), 60 (II, III) and almost 70 (IV) % of the length of the idiosoma. Legs III and IV are almost on the edge of the body, so that their trochanters can be partially seen from above. Length about 540μ, width 440μ.

♀. Creamy-yellow in colour, with pink lateral edges, rostrum and legs. The idiosoma is widely egg-shaped, with a straight truncate posterior edge, gradually widening up to the level of l_1 and then becoming narrower up to the point of origin of sa e; the flattened lateral edges are marked internally by a longitudinal indentation, the distal part is regularly and slightly convex; the outline of the lobes of the lateral edges are more angular than in the ♂, imperceptibly S-shaped. H a, sc i and some of the peripheral setae are slightly bent; v p are 1.5 times longer than sc i and slightly longer than h a; d_4 are quite distinct; sa i are dorsal in position, at some distance from the posterior edge of the idiosoma; the approximate lengths of the setae are v a 8 to 9, v p and sc e 25, sc i 17, h a 23, h p 19, d_1, d_2 26 to 30, d_3 45, d_4 12, l_1 and l_2 24 to 25, l_3 20 to 21, sa e 17, sa i about 20% of the length of the idiosoma. Legs are much shorter and thinner than in the ♂: 40 (I), 35 to 36 (II) and 60 (IV) % of the length of the idiosoma. Legs III and

IV are more medial in position, so that their trochanters and femora are completely concealed by the edge of the idiosoma. Length 750μ, width 660μ.

Distribution. England, Holland, Germany. It lives in moles' nests.

15. Genus Fusacarus Mich.

Michael, 1903, 7.

Type species: Fusacarus laminipes Mich. 1903.

The body is spindle-shaped, very convex (almost round in transverse section), with a narrow anterior end and a strongly pointed posterior; the rostrum is not separate from the idiosoma and completely covers the gnathosoma, the latter being inserted into a deep camerostome. The cuticle is hard, strongly pigmented and smooth. All the setae of the dorsal surface, except sc e, are very thin microsetae, sc e are long and capilliform and v a and v p are also well-developed; both sexes have only 1 pair of postanal setae. A sternum is absent. Epimeres I are fused to form an arc-shaped strut, which outlines the edge of the camerostome; the anal slit is almost terminal and divides the sharp posterior edge of the idiosoma; genital "suckers" are absent. The latero-abdominal or "fat" glands are not developed.

The legs are short, the anterior ones strongly compressed laterally and widening in a dorso-ventral direction, with a wing-shaped keel on the ventral surface of the femur; the posterior ones are less compressed, with genua which strongly narrow towards the base; the leg setae are smooth and thin. Secondary sexual differentiation is not marked and consists mainly in the structure of coxal-sternal skeleton (besides the difference in structure of legs III and IV, which is common to all members of the group).

♂. The idiosoma is slightly narrower, the ventral surface fairly regu-

larly sclerotised; epimeres II are curved and free, but epimeres III and IV are joined, the junction being produced internally and bent at a right angle. The genital opening is placed between the bases of legs III and IV.

♀. The ventral surface of the body seems more massive owing to the cuticle being very dense in places, so as to form wide, shield-shaped regions, divided by transverse lines; one of these is placed just behind the gnathosoma and extends posteriorly as far as the membranous line which encircles the front of the genital opening; others are placed between this line and epimeres II and III. The genital opening is between legs II and III, and is surrounded by a sclerotised ring; it has a very large, unpaired triangular posterior plate and a relatively narrow anterior one.

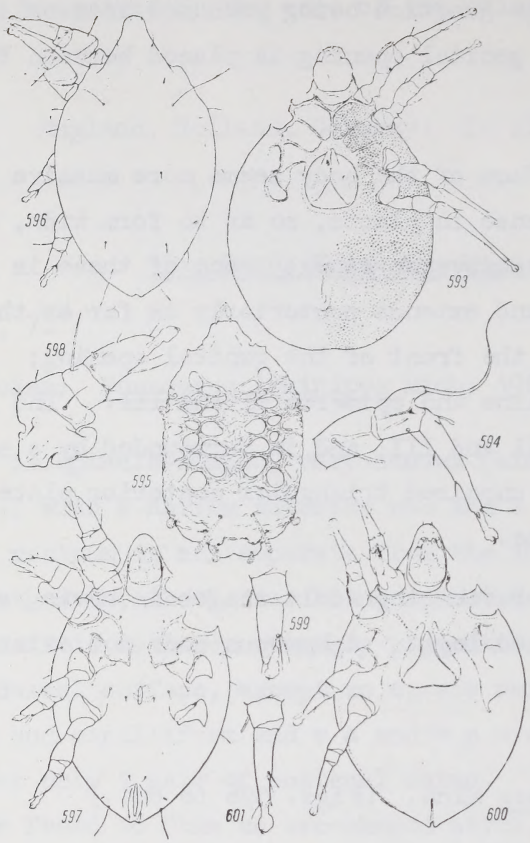
The nymphs differ from the adult stages in having a pale, soft cuticle and non-flattened legs. A hypopus does not exist. This is a monotypical genus.

1. Fusacarus laminipes Mich. (Figs. 596 to 601.)

Michael, 1903, 9, t. XXI.

A rather dark reddish brown in colour, translucent when alive and shining. In the living specimen, the idiosoma is 1.6 (♀) to 2.2 (♂) times longer than its maximum width, which is between legs II and III. V a are noticeably longer than v p, sc i are about one-tenth the length of sc e, the latter being 25% of the length of the idiosoma; h e and v p are about 10% whilst all the remaining setae are 2 to 6% of the length of the idiosoma.

♂. The idiosoma is narrower than in the ♀, strongly pointed posteriorly, with a narrow rostrum. The legs are shorter and broader than in the ♀, equal to about 27 (I, II), 25 (III, IV) % of the length of the idiosoma; the ventral plate of femur I is also wider and the apical seta of



Figs.593 - 601

Fig.593 - Xenoryctes heptneri, sp.n., ♀, dorsal surface. Fig. 594 - X. heptneri, sp.n., leg I, ♀, lateral view. Fig.595 - X. heptneri, sp.n., telonymph, dorsal surface (legs and gnathosoma are not drawn). Fig.596 - Fusacarus laminipes Mich., ♂, dorsal surface. Fig.597 - Ditto, ventral surface. Fig.598 - F. laminipes Mich., leg I, ♂, lateral view. Fig.599 - F. laminipes Mich., ♂, tarsus IV, ventral view. Fig.600 - F. laminipes Mich., ♀, ventral surface. Fig.601 - F. laminipes Mich., ♀, tarsus IV, ventral surface.

the tibia longer. Length 280 to 300μ, width 120 to 130μ.

♀. The idiosoma is noticeably wider, with a blunter posterior end and wider rostrum. The legs are rather long, approximately 32 (I, II), 26 to 28 (III, IV) % of the length of the idiosoma; femur I has a less well-developed ventral plate. Length 300 to 320μ, width 170 to 180μ.

Distribution. It was first found in England. I have only collected it from places near Moscow (Shubgino, in the Kunzef region) and from Irkutsk. It lives in the nests of moles and field mice; the specimen from Irkutsk was found beneath the floor of a granary.

16. Genus Myacarus nom.n.

Homopus C.L. Koch, 1841, Dtsch. Crust. Myriap., Arachn., 39, No. 24 (nom. praeoc. in: Duméril et Bibron, 1835, Reptilia).

Type species: Homopus hypudaei C.L. Koch 1841.

This is only known in the hypopial form. The body is narrow and more elongated than in the hypopi of other genera; the posterior edge is flattened, very narrow and slightly concave in the middle, without a flattened edge plate; the opisthosomal region is outlined, on its lateral side only, by longitudinal or slanting opisthosomal keels, whose bases are ornamented with an indistinct reticulate pattern. The sternum, epimeres and epimerites II are more weakly sclerotised than usual, and epimeres III are free, but curved and very distinctly outlined. The folds of the clasping apparatus are elongated, the posterior claspers being well behind the anterior ones; they are spatula-shaped, with a few transverse ridges; the anterior ones are very small and broadly oval.

Legs I and II are long (35 to 40% of the length of the idiosoma), very slender; the tarsi are also slender, slightly flattened laterally and S-shaped in profile; distally, they have 3 short, but broadly leaf-

shaped setae and 1 long one, which is enlarged distally; the ventral seta of the tarsus which is nearest the base, the ventral setae of the tibia, and both basal setae of the genu are distinctly pectinate or serrated; the apical dorsal seta of the tibia is fairly short and blunted at the end. Legs III and IV are very short (15 to 20% of the length of the idiosoma) and slender; tarsi III have a well-developed distal claw and 4 leaf-shaped setae; tarsi IV are narrow, cylindrical (2 to 4 times longer than their diameter), terminating in a very long, keel-shaped seta, and without a claw; the remaining setae of legs III and IV are short, smooth and pointed.

Two species have been described, which up to now have been confused with each other.

Myacarus

Hypopi

1(2) Propodosomal shield more than 1.5 times wider than long (at its base), with a rectangular anterior edge; epimeres III narrow; tarsi I and III appreciably shorter than the genu and tibia taken together; ventral internal seta of tibiae I and II much more distal in position than the external. France, Holland, Germany, U.S.S.R. (near Moscow, north-west of Kazakhstan, Kirghizia, Chantar Islands).

1. M. arvicolae Duj.

2(1) Proposodomal shield not more than 1.3 times wider than long (at its base), with a pointed anterior edge; epimeres III very wide; tarsi I and II longer, equal in length to the 2 preceding joints taken together; the 2 ventral setae of tibiae I and II are placed at the same level. Germany, U.S.S.R. (near Moscow and the river Amour).

2. M. hypudaei Koch.

1. Myacarus arvicolae Duj. (Figs. 572 to 576.)

Dujardin, 1849, Ann. Sci. nat. Zool., Ser. 3, Vol. XII, 249, 264, t. II, Figs. 15, 16 (Hypopus); Oudemans, 1900, Tijdschr. Entomol., XLVI, 126, t. 6, Figs. 39 to 40 (Dermacarus). - hypudaei Oudemans, 1915, Entomol. Ber., IV, 199 (Dermacarus).

Hypopus. The body is 1.6 to 1.7 times longer than its width; the anterior edge of the propodosoma is right angled and its width at its base is more than 1.5 times greater than its length; the opisthosomal keels converge anteriorly and are noticeably concave. The pleural fields have a well-defined arched line, which runs from the external edge of acetabula III towards the base of legs II, encircling epimeres II externally; epimeres III are narrow. The folds of the clasping apparatus are one-fifth the length of the body, their posterior edges are only separated from the posterior edge of the body by a very narrow space; the transverse ridges on the internal surface of the folds are weak and barely noticeable; the anterior claspers are broadly oval, with 4 transverse ridges, the posterior are shaped like spatulae with 6 to 7 ridges.

The tarsi I are much shorter than the 2 preceding joints and are slightly S-shaped in profile; the sensory rod is straight, somewhat expanded distally and in the proximal half of the tarsus; beta is a fairly large conical spine; the posterior ventral seta is slightly distal to the sensory rod, but its end by no means reaches the apex of the tarsus, it is thick and serrated; the ventral setae of the tibia and basal setae of genua I and II are comparatively short and finely serrated; the internal ventral seta of the genu is considerably distal to the external one. Tarsi III are fairly slender, barely as long as tarsi IV; the ventral seta of tibia III is shaped like a spine. Length 275 to 400μ, width 155 to 250μ.

Distribution. France, Germany, Holland, U.S.S.R. I have found it in many places in the Moscow region, the north-western Kazakhstan (near Kustanaja), in Kirghizia and from the Chantar Islands.

Ecology. It was found on the field mice Microtus (Pytimys) subterraneus Selys (Dujardin 1849), M. arvalis L. and Evotomys glareolus Schr. (Oudemans 1915), the water rat Arvicola amphibius L. (Oudemans, l.c.), the hamster Cricetus cricetus fuscidorsis Arg., Cricetulus migratorius Pall., the lemming Lagurus lagurus Pall., the striped squirrel Eutamias asiaticus orientalis Bonn (on the Chantar Islands); on the mole and field mouse Sorex araneus L.

2. Myacarus hypudaei C.L. Koch (Figs. 568 to 571.)

C.L. Koch, 1841, Dtsch. Crust., Myriap., Arachn., 39, No. 24 (Homopus).

Hypopus. This is usually larger than the preceding species, the body being still more elongated, 1.8 to 1.9 times longer than its width; the propodosoma and opisthosoma are particularly long; at its anterior end, the propodosoma forms an acute angle, and at its base is only 1.3 times wider than its length; the opisthosomal keels are almost parallel with each other, but are perceptibly curved. The pleural arcs are usually absent; epimeres III are strongly widened. The folds of the clasping apparatus are usually longer (they are one-quarter the length of the body) and are separated by a wide space from the strongly indented posterior edge of the body; the transverse ridges on the internal surfaces of the folds are more pronounced and more strongly sclerotised; the anterior claspers are oblique, their ridges arranged diagonally; the posterior claspers have 4 to 5 transverse ridges.

Tarsi I are longer (approximately equal to the combined length of the tibia and genu) and, when seen in profile, are more sharply bent; the sensory rod and associated setae are more distal and nearer to the middle of the tarsus; beta is very small, barely noticeable; the posterior (proximal) ventral seta is strongly pectinate; the ventral setae of the tibia and the basal setae of genua I and II are also longer and more distinctly pectinate than in M. arvicolae; the internal ventral seta of the tibia is at the same level as the external and proximal to

the middle of the segment; tarsi III are shorter and thicker, whilst the ventral seta of tibia III does not resemble a spine. Length 365 to 430μ, width 205 to 225μ.

Distribution. Germany, U.S.S.R. I have only found it in some parts of the Moscow region and the river Amour.

Ecology. The hypopi were found on field mice: Microtus arvalis L. and Evotomys glareolus Schr., on the mole and another mouse Crocidura lasiura Thos.

I am adopting Koch's name, on account of the long length and narrowness of the propodosoma and legs, which are shown in his drawings.

6. Subfamily Carpoglyphinae

In most cases the gnathosoma is very slender and mobile, with feebly toothed chelicerae. The idiosoma is ellipsoid, very convex or almost rhomboid; sometimes it is flattened dorso-ventrally; sometimes the division into propodosoma and hysterosoma is slightly indicated and a rostrum is absent. The cuticle is fairly thick, smooth or covered with spines or with a mosaic of strongly sclerotised, round plates (males of Hericia F. and R.); a propodosomal dorsal shield is usually present. All the dorsal setae of the idiosoma are smooth, somewhat stiff, short or medium in length; sa e and one of the postanal pairs is longer and function as caudal setae; the number of pairs of dorsal and lateral setae varies, but it never exceeds 15; their arrangement is confusing and deviates from the normal. A pseudostigmatic organ is absent. The coxal-sternal skeleton differs in ♂ and ♀. The legs are medium in length (adapted for walking), fairly slender, or rather massive, often modified; all their ventral setae are smooth; the apex of the genu has 2 stout setae. The praetarsi are large, like stalks, with a large terminal claw.

♂. The sternum is very long and fused posteriorly with the epiandrium,

to the external angles of which epimeres II are also joined, so as to form a W-shaped figure. The genital opening is placed between the bases of legs IV or more posteriorly; it is usually surrounded by a thin, sclerotised frame. Legs I and II (Carpoglyphus) and II and IV (Hericia, some Hyadesia) are more or less sharply modified.

♀. The sternum and epimeres II are joined internally with the epigynium or else almost touch it. The epigynium may be crescentic or shaped like a horseshoe, very large, but thin. The edges of the genital folds are rather thickened.

Nymphal stages are not well known. Hypopi are formed in Hericia and possibly in Carpoglyphus.

In this family are placed 3 genera: (1) Carpoglyphus Robin, placed by Oudemans in a separate family with the genus Ferminia; (2) Hericia Canestrini; (3) Hyadesia Megnin. (This also used to be considered as the representative of a separate family - the Lentungulidae (Michael, Oudemans); perhaps the Malayan species Fusohericia Vitzthum should also be included in it. All the species included here are semi-aquatic, living in liquid or semi-fluid media.

6. Subfamily Carpoglyphinae

1(2) Tarsi I and II very short, ending in a stout process at the base of which arises an extraordinarily fine, long, flexible praetarsus, this has a relatively small claw on its distal extremity; praetarsi III and IV are short or completely reduced, with a larger claw than on the anterior legs; the idiosoma has a fairly distinct transverse constriction. Species littoral, living among Algae.

17. Hyadesia Megn.

2(1) All the tarsi are normal in structure, without a strong process; praetarsus wide, of the usual shape; idiosoma completely

devoid of transverse constriction. Terrestrial species, sometimes living in liquid or semifluid substances.

3(4) Cuticle smooth, all the setae of the dorsal surface of the idiosoma, except sa e, short, rounded at their ends; genital "suckers" well-developed; legs III and IV normal in structure in the 2 sexes; in the ♀, epimeres I and II are united with the epigynium.

18. Carpoglyphus Rob.

Only 1 palearctic species, C. lactis L. Europe, N. America.

4(3) Cuticle scaley, often covered with numerous small cuticular spines; setae of the idiosoma longer and stronger; genital "suckers" rudimentary; in the ♂, legs III are strongly elongated, the fourth pair swollen and bent; in the ♀, epimeres I and II are free.

19. Hericia Can.

17. Genus Hyadesia Mégn.

Mégnin, 1889, Miss. Scient. Cap. Horn, VI, 3, Protozoaires: 51; André, 1931, Bull. Mus. Paris (2) III, 496, Figs. 1 to 6. - Lentungula Michael 1893, Proc. Zool. Soc. London, 262; Berlese, 1897, 103; Lohmann, 1894, Wiss. Meeresunters., I, 1: 89; Kramer, 1899, 136; Michael, 1901, 192.

Type species: Hyadesia uncinifer Mégn. 1889.

The gnathosoma is fairly massive, with normal chelicerae. The idiosoma is dark in colour (the dark colour is due to the contents of the alimentary canal, and perhaps to stored food; it is not due to pigment in the cuticle, which is transparent and practically colourless), much rounded, and with a fairly well-defined transverse groove which separates the propodosoma and hysterosoma. The idiosoma has strongly marked scapular regions and the posterior edge is usually slightly rounded in the middle. The cuticle is smooth, finely wrinkled in parts, or

finely punctate; a propodosomal shield is usually distinct and is transversely extended (rather like a horseshoe); eyes are absent. The dorsal surface of the idiosoma bears setae of various lengths: sc e, h p, sa e and sometimes v a, sa i and l_3 are long, the remainder short; d_1 are close to the humerals, d_2 are on a level with d_1 and near the mid-line. No latero-abdominal or "fat" glands are present and genital "suckers" are also absent.

Legs I and II are strongly flattened laterally, broad, with a short tarsus, terminating in a large claw formation (fused and immobile with the tarsus) and bearing 1 small spine; at the base of the "claw", there arises an extraordinarily long, thin, flexible praetarsus, broadened distally into a small expansion, to which is joined a thin, hooked claw; one of the ventral setae of the tibia is modified into a massive spine, the remaining setae of the legs are thin and fairly flexible. Legs III and IV are more slender, cylindrical and usually with a well-developed tarsus, this bears a normal-sized or reduced praetarsus and a larger claw than that on the anterior legs (in the ♂ of H. fusca, tarsi III and IV are considerably shortened, in structure resembling tarsi I and II). Secondary sexual differences are usually very marked.

♂. The idiosoma is considerably more slender than in the ♀ and narrows towards the posterior end; the scapular protrusions are more smoothly rounded. Epimeres III and IV are always well-developed and separate from one another. The bases of legs IV are considerably displaced anteriorly and are almost in the same transverse line as those of legs III; on the ventral sides of tarsi I, III and IV, there is a rounded membranous sucker; in some species, tarsi III and IV are short and resemble in structure the tarsi of the anterior legs. The genital slit is slightly behind the bases of legs IV and is surrounded by an oval, sclerotised ring.

♀. This is larger than the ♂, with more sharply protruding scapular regions. The sternum and epimeres II are free. Epimeres III and IV

are joined or are not clearly defined. Legs IV are joined to the body immediately behind legs III, their tarsi have no suckers; the posterior tarsi are always normal in structure, and much longer than the tibia. The genital slit is between the bases of legs III and IV or more posterior to them, it has a sclerotised valve, with a fairly well-defined oval indentation; the epigynium is arched or absent.

The nymphal stage closely resembles the adult. Hypopial stages are absent.

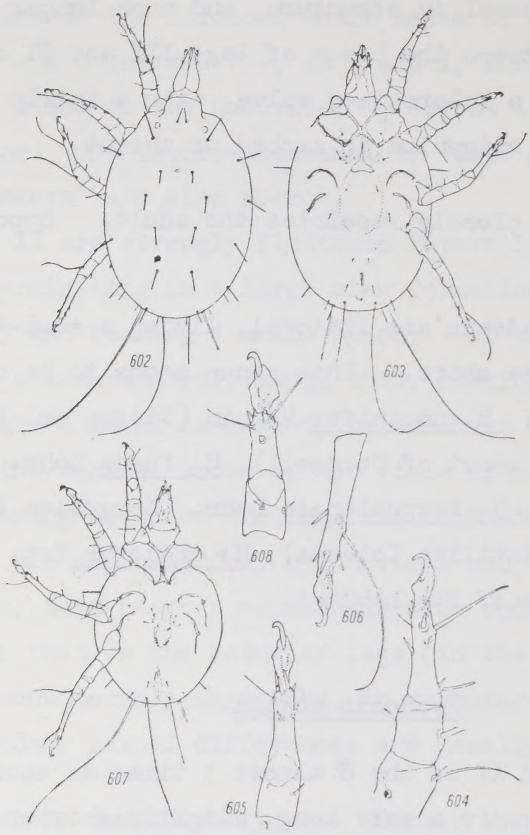
All species of Hyadesia are littoral, living a semi-aquatic life on green seaweed of the sea shore. This genus seems to be cosmopolitan, and contains 6 species: H. uncinifer Mégnin (Tierra del Fuego), H.algivorans Mich. (Atlantic coast of Cornwall), H. fusca Lohm. (borders of North and Baltic Seas), H. kerguelensis Lohm. (Kerguelen Islands), H. curassavienvis Viets (Antillan Islands), H. chelopus Trt. (Indian Ocean) with no further details of its habitat.

Hyadesia Mégnin.

1(2) Tarsi III and IV of the ♂ almost 3 times as short as the corresponding tibiae; v a very long, slightly shorter than sc e and and h p; all the dorsals and laterals are very short, almost the same length; ventral spine of tibiae I and II 4 to 5 times shorter than the diameter of the tibiae, and conical; genital opening of the ♂ small, separated by a wide space from the end of the sternum; ♀ without epigynium. Germany, Ireland.

1. H. fusca Lohm.

2(1) Tarsi III and IV in both sexes longer than their corresponding tibiae; v a less than half the length of sc e and h p; dorsal and lateral setae fairly long (13 to 30% of the length of the idiosoma); d_2 appreciably longer than d_1, l_3 almost 1.5 times longer than d_2; ventral spine of tibiae I and II slightly shorter than the diameter



Figs. 602 - 608. Carpoglyphus lactis L.

Fig. 602 - ♀, dorsal surface. Fig. 603 - Ditto, ventral surface. Fig. 604 - Leg I (part of genu, tibia and tarsus), lateral view. Fig. 605 - Tarsus I, ventral surface. Fig. 606 - Tarsus III, ventral surface. Fig. 607 - ♂, ventral surface. Fig. 608 - Ditto, tarsus I, ventral surface.

of the tibia; genital opening of the ♂ very wide, almost touching the end of the sternum; ♀ with a large arched epigynium. England.

2. H. algivorans Mich.

1. Hyadesia fusca Lohm. (Figs. 23, 618 to 623.)

Lohmann, 1896, Wiss. Meeresunters., 1: 85, t. IV; Kramer, 1899, 136 (Lentungula).

The idiosoma is dark brown, the propodosomal shield, legs, gnathosoma and coxal-sternal skeleton is reddish brown. The cuticle is finely wrinkled and smooth in parts; the surface of the propodosomal shield is finely pitted. V a are very long (30 to 50% of the length of the idiosoma); sc e and h p are only slightly shorter; sc i, h a and h p, d_1 to d_4, l_1 and l_3 are all about the same length (5 to 7%); sa i are half the length of sa e (approximately equal to half the length of the idiosoma); d_2 are much further apart than d_3. The ventral spine of tibiae I and II is conical, 4 to 5 times smaller than the diameter of the tibia. Sexual dimorphism is more pronounced in this species than in the next one.

♂. Epimerites II are joined at their external ends with acetabula II, and at their internal ends with epimeres III; the latter extend medially towards the ends of epimeres IV and run parallel with these for a certain distance. Legs III and IV are noticeably short (25 to 28% of the length of the idiosoma). Owing to the reduced length of the tarsus, legs III and IV are much shorter, the tarsus being one-third the length of the tibia and armed with a bent seta, resembling a similar seta on tarsi I and II, but rather smaller in size. Praetarsi III and IV also resemble I and II, but again, are rather shorter. The sclerotised ring surrounding the genital opening is very small, and separated by a considerable distance from the end of the sternum. Length about 400μ.

♀. This is noticeably larger than the ♂. Epimeres III and IV are well-developed, and with epimerites II form a diagonal sclerotised line with 2

projections (the external parts of the epimeres), which extend to the bases of legs III and IV. Tarsi III and IV are noticeably longer than the corresponding tibia, gradually tapering distally, and devoid of setae; their praetarsi are well-developed, considerably thicker than I or II. An arched epigynium is absent, and the anterior end of the genital opening is on the same transverse line as the anterior edges of acetabula IV. Length about 500μ.

Habitat. Germany, the Islands of Heligoland, the shores of the North and Baltic Seas and Ireland. It lives in isolated large colonies among the mass of green seaweeds on stones, piers etc., near the edge of the water.

2. Hyadesia algivorans Mich. (Figs. 615 to 617, 624 to 627.)

Michael, 1893, Proc. Zool. Soc. London, 262, t. XVIII; 1901, 196, t. I; Kramer, 1899, 136 (Lentungula).

The idiosoma is olive brown in colour, usually with a light yellow marbled design, the cuticle is a light yellow, the gnathosoma, legs and coxal-sternal skeleton a pinkish yellow; the outline of the propodosomal shield is not distinct and the surface of the cuticle is absolutely smooth. V a are short (13 to 15% of the idiosoma), 3 times shorter than sc e and h p, which are 45 to 50%; sc i, h a and d_1 are about 14 to 15%, d_2 are almost 1.5 times longer than d_1; d_3 and l_2 are 17 to 18%, l_1 12% and l_3 about 27%, sa e 30% and sa i 40% of the length of the idiosoma; sa i are thus considerably longer than sa e, and the dorsals and laterals are of very different lengths; d_2 are much nearer to each other than are the widely-separated d_3. The ventral spine of tibiae I and II is cylindrical, slightly shorter than the diameter of the tibia and with a pointed end; in both sexes, tarsi III and IV are considerably longer than the tibia, tapering towards the end and devoid of spines; praetarsi III and IV are very short and similar in structure in both sexes. Lengths of both ♂ and ♀ 380μ. Secondary sexual characters are not pronounced.

♂. Epimeres II are not joined with acetabula II, nor with epimeres III, the ends of the latter barely reaching the bent part of epimeres IV. Legs III are 35% and IV 40 to 42% of the length of the idiosoma. The sclerotised ring surrounding the genital opening is very large, almost touching the end of the sternum.

♀. Epimeres III and IV are not distinct. The epigynium is well-developed as a crescentic sclerite; the front end of the genital opening is considerably anterior to acetabula III.

Habitat. It has only been found on the western shores by Land's End, England. It has only been found once by Michael among a collection of green Algae (Cladophora fracta) on some rocks in a place where the fresh water of a small stream had trickled down the surface of granite within reach of sea water.

18. Genus Carpoglyphus Robin

Robin, 1869, Journ. Anat. Physiol., VI, 197; Berlese, 1898,XCI, No. 13; Kramer, 1899, 148; Michael, 1903, 42. - Phycobius Canestrini, 1888a, 355.

Type species: Acarus lactis L. 1758.

The gnathosoma is very narrow and unusually mobile and the chelicerae have very thin scissor-shaped shears. The idiosoma is slightly flattened, oval and elongated, with a rounded or almost straight posterior edge and smooth, slightly protruding shoulder regions, which are the same shape in both sexes. The propodosoma is not separated from the hysterosoma. The cuticle is smooth and a propodosomal shield is not defined. The rostrum bears anteriorly a pair of rounded eyes, which have no pigmented retinae. All the setae arising from the dorsal surface of the idiosoma are short and smooth; sc e are slightly longer than the others, whilst sa e are very long and terminal in position; p_3

are also very long. The latero-abdominal or "fat" glands are well-developed and displaced to the posterior edge of the idiosoma. The genital folds are well-developed in both sexes and truncate. Epimeres III and IV are free and wide apart at their ends.

The legs are fairly slender and unmodified; legs IV are considerably posterior to legs III. The setae of the legs are short and fairly stiff. All the apical dorsal setae of all the tibiae are long. The praetarsi are large and flattened, similar in structure on all the legs. The claws are large. Secondary sexual differences are fairly numerous, but the differences themselves are not so marked as in other genera.

♂. Legs I and II are noticeably thicker than in the ♀, with dilated praetarsi and a slightly different arrangement of setae at the distal end of each tarsus. The genital opening is placed between the bases of legs III and IV and has no sclerotised ring.

♀. Legs I and II are slender, their praetarsi the same size as those of legs III and IV. The sternum and epimeres II are fused at their ends with a massive angular epigynium; the genital opening is placed between the bases of legs II and III, its folds are not sclerotised.

In the nymphal stages the eyes are relatively large and more easily detected than in the adults; the larvae have no "bruststiele". A hypopus has been described in 1 species.

To the genus Carpoglyphus belong 2 species: the cosmopolitan C. lactis and C. alienus Banks 1906, which was found in Java in human urine and is considered an endoparasite. C. vagabundus Berlese 1910 is insufficiently described and probably belongs to the subfamily Chaetodactylinae.

1. Carpoglyphus lactis L. (Figs. 20, 602 to 608.)

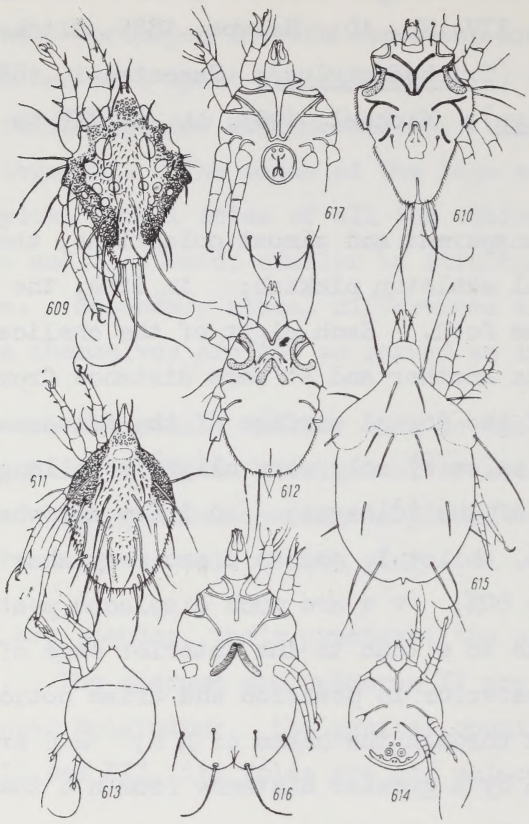
Linné, 1758, Syst. Nat., ed. X, 1024, sp. 16 (Acarus). - dysenteriae Linne 1758, l.c., sp. 17 (Acarus). - passularum Robin, 1869, Journ. Anat. Physiol.

VI, 197; Berlese, 1897, 105; Kramer, 1899, 148 (Carpoglyphus). - anonymus Haller, 1882, Jahresb. Ver. Wurttemb., XXXVIII, 297 (Glycyphagus); Berlese, 1884, XIV, No. 10; Nalepa, 1885, Sitzber. Akad. Wiss. Wien, XCII, Abt. 1: 1 (Trichodactylus); Canestrini, 1888, 22; 1889a, 392, t. XXXV (Phycobius); Michael, 1903, 44, t. XXV to XXVI, Figs. 8 to 21 (Carpoglyphus).

This is semi-transparent and almost colourless, the legs, gnathosoma and coxal-sternal skeleton pinkish; in life, the colour varies with the nature of the food. Each digit of the chelicera has 3 teeth, which are close to one another and at some distance from the end of the digit. The setae of the dorsal surface of the idiosoma (except for the very long ones, such as sa e) only vary slightly in length, they are 8 to 10% of the length of the idiosoma; sc i are somewhat longer than the others, 13 to 17%, whilst l_3 and sa i are very short, 4 to 7%, sa e are 100% and p_3 70 to 80%; v a are much displaced posteriorly and are considerably nearer to sc e than to the anterior edge of the rostrum; sc i are also more posterior in position and arise noticeably behind a transverse line drawn through the bases of h a; h p are on a level with d_1 and separated by a greater distance from h a than from l_1; l_3 are ventral in position.

♂. Sc e are almost twice as long as sc i. Legs I and II are considerably shorter and thicker than legs III; the tarsi are thick: 2 or 2.3 times longer than their diameter at the base, with a reduced middle apical spine, a massive external one and only 1 broad spine on its middle region. Length 240 to 400μ.

♀. Sc e 1.5 times longer than sc i. Legs I and II are almost the same length and thickness as legs III; the tarsi are slender, 3 times longer than their diameter at the base; on their ventral surfaces each has 3 equally developed apical spines and an additional fourth on the internal surface of the segment. Length 250 to 450μ.



Figs. 609 - 617

Fig. 609 - Hericia hericia Rob., ♂, dorsal surface (after Michael). Fig. 610 - Ditto, ventral surface (after Michael). Fig. 611 - H. hericia Rob., ♀, dorsal surface (according to Michael). Fig. 612 - Ditto, ventral surface (according to Michael). Fig. 613 - H. hericia Rob., hypopus, dorsal surface (according to Michael). Fig. 614 - Ditto, ventral surface (according to Michael). Fig. 615 - Hyadesia algivorans Mich., ♀, dorsal surface (after Michael). Fig. 616 - Ditto, ventral surface (after Michael). Fig. 617 - H. algivorans Mich., ♂, ventral surface (after Michael).

Distribution. All Europe, N. America, it is probably carried on food products to other parts of the world. In the U.S.S.R. it has, up to now, been found in Moscow, Leningrad, Kazan and Armavir.

Ecology. It is mainly a synantropic species, living on various substrates, solid as well as fluid; it is almost exclusively found on substances containing lactic, acetic and succinic acids. It is often found on dried fruit, old honey combs, sour jams and other fruit products, on rotten flour, old cheese, decaying potatoes, sour milk and dough, rotten wood, fruit drinks, beer and wine. As it multiplies to enormous numbers on these substrates, C. lactis may have a noticeable economic and medical significance (there are indications that it can give rise to acute stomach and intestinal trouble); in spite of this, its biology has not been studied in detail.

19. Genus Hericia

Canestrini, 1888, 6; 1888a, 355; Berlese, 1898, LXXXVII, No. 12; Kramer, 1899, 143; Michael, 1903, 29.

Type species: Glycyphagus hericius Rob. 1868

The gnathosoma is very slender and flexible, the digits of the chelicerae thin, but not so thin as those of Carpoglyphus. The idiosoma is dorso-ventrally flattened, approximately rhomboidal in shape and without a dorsal transverse groove. The cuticle is very rough, sometimes densely covered with fine spiniform projections; the propodosomal shield is well-developed and elongated; eyes are absent. The setae of the dorsal surface of the idiosoma are stiff and fairly long, their position and length (of sc, d_1 and h) different in ♂ and ♀. The genital suckers are strongly reduced. The latero-abdominal or "fat" glands are absent. The legs are long and quite different in the two sexes; tarsi I and II are unmodified and the majority of the leg setae are converted into spines. The praetarsi of all the legs are about the

same in structure, they are small, with large claws. Secondary sexual differences are well-marked.

♂. The scapular region of the idiosoma is wider and flatter than in the ♀, and posteriorly the body narrows more sharply; the sculpturing of the cuticle is coarser; sa e and p_3 are very long; d_2 are close to sc and placed on the same transverse line as d_3. Epimeres III and IV are joined internally and the epimerites are well-developed. Legs I and II are fairly strongly thickened; legs III are long and thin, lateral in position and on the same transverse line as legs IV, whose bases are displaced forwards; legs IV are shorter than the others, noticeably thicker than in the ♀, with slender, flexible setae; there are no ventral suckers on the tarsi. The genital opening is behind the base of legs IV, and is not surrounded by a sclerotised ring.

♀. Sc e and p_3 are shorter, d_1 arise at a considerable distance from sc and are considerably anterior to d_2. The sternum and epimeres II to IV are free and epimerites IV are not developed. The legs are thin, long, and have the same proportions; legs IV are marginal in position, like legs III, and arise behind them. The genital opening is between legs III and II, with a sclerotised fold and a large horseshoe-shaped epigynium.

The larvae are conspicuous on account of their dark colour, smooth cuticle and strongly-developed seta on tarsus III. This exists in all species. The dorsal surface of the idiosoma is completely covered by both dorsal shields, which have a rough surface. The sternum and epimeres II to IV are free. The outlines of the sucking disc are not clear; the anterior suckers are small and capable of being protruded a long way; the central suckers are fairly large and of the usual structure; the external and posterior suckers are verysmall and project from a curved sclerite, which is parallel to the posterior edge of the body. The legs are long and slender (particularly the anterior ones), with a well-developed oval praetarsus and small claws; tarsi III and IV have fairly

long macrosetae.

There are 2 European species, of which one has been inadequately described. The Indian Hericia greeni Ouds. 1916, as has been shown by Vitzthum 1924, belongs to the genus Sennertia (Chaetodactylinae).

Hericia Can.

1(2) Skin densely covered with fairly long cuticular spines; males larger than the females, more strongly coloured, their dorsal surfaces covered with a number of strongly chitinised, slightly sunk platelets; tarsi II of the ♂ with 2 strong ventral spines, side by side, at the same level. Total length of the ♂ 520 to 600µ, of the ♀ about 500µ. England, France.

1. H. hericia Rob.

2(1) Skin without cuticular spines; males smaller than the females, and the same whitish colour, without chitinous platelets on the dorsal surface; tarsi II of the ♂ with 3 less well-developed spines placed along the tarsus, one after the other. Total length of the ♂ about 460µ, of the ♀ 750µ. England.

2. H. georgei Mich.

1. Hericia hericia Rob. (Figs. 609 to 614, 628 to 635.)

Robin, 1868, Journ. Anat. Physiol., V, 603 (Glycyphagus). - robinii Canestrini, 1888, 22; Berlese, 1897, LXXX, No. 5; Michael, 1903, 31, t. XXIII to XXIV. - hericia Kramer, 1899, 144 (Hericia).

In life, this is pale yellow brown, the gnathosoma and legs having a reddish tint. The cuticle is slightly pitted and covered with fairly long cuticular spines; the surface of the propodosomal shield is covered with shallow indentations and resembles a honeycomb.

♂. On the dorsal surface of the idiosoma, there are 8 pairs of symmet-

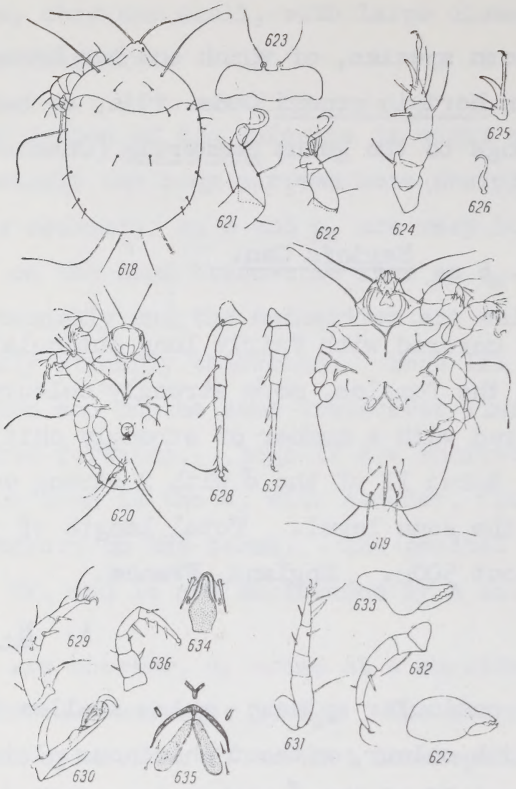


Fig. 618 - 637

Fig. 618 - Hyadesia fusca Lohm., ♀, dorsal surface (after Lohmann). Fig. 619 - Ditto, ventral surface (after Lohmann). Fig. 620 - H. fusca Lohm., ♂ , ventral surface (after Lohmann). Fig. 621 - H. fusca Lohm., end of tibia and tarsus IV, ♀ (after Lohmann). Fig. 622 - H. fusca Lohm., the distal end of genu, tibia and tarsus IV, ♂ (after Lohmann). Fig. 623 - H. fusca Lohm., propodosomal shield (after Lohmann). Fig. 624 - H. algivorans Mich., leg I (after Michael). Fig. 625 - H. algivorans Mich., tarsus I (after Michael). Fig. 626 - H. algivorans Mich., penis (after Michael). Fig. 627 - H. algivorans Mich., Chelicera (after Michael). Fig. 628 - Hericia hericia Rob., leg IV, ♂ (after Michael). Fig. 629 - H. hericia Rob., leg I, ♂ , (according to Michael). Fig. 630 - H. hericia Rob., end of tarsus and ambulacrum of ♂ (according to Michael). Fig. 631 - H. hericia Rob., leg II, ♂ (according to Michael). Fig. 632 - H. hericia Rob., leg IV, ♀ (according to Michael). Fig. 633 - H. hericia Rob., chelicera (according to Michael). Fig. 634 - H. hericia Rob., penis, and associated structures (according to Michael). Fig. 635 - H. hericia Rob., genital opening, ♀, with epigynium (according to Michael). Fig. 636 - H. georgei Mich., leg II, ♂ (according to Michael). Fig. 637 - H. georgei Mich., leg III, ♂ , (according to Michael).

rically placed round or oval chitinous platelets, which are densely and finely pitted; in the living specimens these platelets are noticeably indented. V a, sc e and sc i, sh and d_4 are approximately the same length (19 to 23% of the length of the idiosoma); d_1 is shorter than the other setae; d_2, d_3 and l_2 are about 26 to 28%; h a, h p and l p are 35 to 45%, l_3 up to 60% of the length of the idiosoma; sa e are equal in length to the idiosoma and arise from large protrusions. The legs are about 57 (I), 62 (II), 70 (III) and 54 (IV) % of the length of the idiosoma; the ends of the tarsi, particularly of tarsi III, are very oblique, with a strongly projecting ventral edge, from the base of which arises a short, globular praetarsus and the base of the claw; it also bears a large, dorsal spine; tarsi II have, on their ventral sides, 2 knife-shaped spines, placed close together on the same level; legs IV are curved and have fewer setae than the other legs. Average length 520µ, width 350µ.

♀. The dorsal surface of the idiosoma has no chitinous platelets. H p, d_2 to d_4 are much longer than in the ♂, l_3 much shorter; the approximate lengths of the setae are v a 20, sc e 15, sc i 18, h a 50, h p 35, sh 30, d_1 18, d_2 40, d_3 48, d_4 42, l_1 42, l_2 15, l_3 40, sa e about 50% of the length of the idiosoma. The legs are 48 (I), 50 (II), 53 (III), 60 (IV) % of the length of the idiosoma, they are much slenderer than in the ♂ and more feebly cuticularised. Length approximately 500µ, width 330µ.

Hypopus. This is a dull yellow in colour when alive, with a regular spotted and reticulate pattern. The body is widely elliptical (1.3 times longer than its width); anteriorly, it has a narrow, strongly protruding rostrum, and posteriorly, it is widely rounded. Length about 170µ, width 130µ.

Distribution. It is certainly only known in France and England. It lives on the trunks of oaks and elms, and in the sap oozing out of cracks caused by injury, or in places beneath the bark, which are also wet with

sap. The descriptions and drawings of Berlese differ from those of Robin and Michael in many details, and it is possible that H. hericia is a collective species; I cannot settle this question, as I have no material. The present description was compiled from Michael's work.

2. Hericia georgei Mich. (Figs. 636, 637.)

Michael, 1903, 38, t. XXXIX, Figs. 5 to 12.

A doubtful inadequately described species, it differs from the preceding one in having a whitish colour and a skin without cuticular spines, no dorsal apical spine arises from tarsus I in the ♂, and the ♂ also has 3 ventral spines placed behind each other on tarsus II; the idiosoma is more regularly oval in shape and in the ♂ is wider than in H. hericia; also the ♂ is much smaller than the ♀. Total length of the ♂ 460μ, ♀ 750μ.

Hypopus. It differs from that of the previous species in having a widely rounded anterior edge to the body.

Distribution. England. It has been found once under the peeling bark of a poplar damaged by Cossus cossus L. It was found in large numbers on the very damp parts of the trunk impregnated with the sap which was seeping out of it.

7. Subfamily Chaetodactylinae

The idiosoma is wide (1.1 to 1.5 times longer than its width), slightly flattened and almost hexagonal in shape; in some species there is a slightly marked division into propodosoma and hysterosoma; there is no rostral protrusion. The cuticle is soft, colourless, of a soft membranous consistency, finely covered with small projections or with triangular cuticular protrusions (squamoids); sometimes it is striated, the striations consisting of transverse rows of small protru-

sions (genus Chaetodactylus); in one series of species, there is a more or less clearly defined propodosomal shield, which often forms laterally a pair of thick sclerotised lines, which extend up to the base of legs II and resemble the so-called peritreme of the suborder Parasitiformes. The setae of the dorsal surface of the idiosoma are pectinate or serrated, usually very short; in some species, nearly almost all are shaped like discs (sc and d_1 to d_4, sometimes l_1 and l_2) and rather reduced; v p are often absent; there are 3 pairs of humeral and lateral setae; sa e are usually longer than all the other setae of the body and are terminal in position; the pseudostigmatic organ is simple, like a seta, or else it is absent. The structure of the coxal-sternal skeleton varies, but epimeres I and II are never joined at their ends.

The legs are slender, with moderately long, thin and sometimes slightly bent tarsi; the setae of the tibia and genu are more or less pectinate or serrated; the apex of genu I has 2 sense organs: a small rod-shaped sensilla, with a simple seta next to it; the apical setae of tibiae I and II are fairly short, those of tibiae III and IV are completely reduced; the chaetotaxy of the tarsi consists of several smooth setae. Each ambulacrum is composed of a praetarsus, with a fairly large (very large in Sennertia) sickle-shaped claw on its distal end. Secondary sexual differences are slight and do not affect the chaetotaxy of the legs.

♀. The genital opening is usually very large, with well-developed folds which diverge slightly at their posterior ends; in most cases it is strongly displaced anteriorly; the epigynium is absent, but in many species of Sennertia and Horstia epimeres I are joined by a sclerotised connection, which anteriorly joins the genital opening; genital "suckers" are small or absent; in some species there is a slightly protruding copulatory tube. The nymphs are not well known.

Distributive hypopi occur in all known species (most are only known in this stage) and are distributed by insects. The gnathosoma in some is strongly reduced and represented by a pair of swellings which terminate

in short arists, or it may be completely fused with the idiosoma. The shape of the latter varies considerably; in many it is strongly flattened, in others it has a somewhat convex surface. The division into propodosoma and hysterosoma is not complete and is marked only by the presence of 2 separate dorsal setae or (in the genus Sennertia) it is completely absent. The dorsal shields are often surrounded by extensive areas of soft membranous cuticle, often clearly striated; the surface of these shields is densely pitted and ornamented with a reticulate pattern, similar to that found in hypopi of the Saproglyphidae; alternatively, it may be covered with an indented sculpturing. The setae of the dorsal surface are often long and stiff. The ventral surface of the body is covered with a soft thin cuticle. The coxal-sternal skeleton varies in structure, but coxal fields III and IV are always separated by a wide space and the sternum often has a divided end. Some coxal setae are always present, but they are modified. The sucking disc has 3 pairs of suckers and its surface is often divided into several independent sclerites.

Legs I to III are massive and often completely marginal (Sennertia and Chaetodactylus); legs IV are usually shorter than the others and terminate in 1 to 3 macrosetae. The praetarsi are narrow, cylindrical somewhat folded or else reduced; the claws are sometimes enormous and in such cases spirally twisted. The chaetotaxy of the legs varies considerably, but all the setae are smooth; on the tarsus some of the apical and ventral setae are broadened into a leaf-shape. Inert hypopi are found in the genus Chaetodactylus (together with the active ones). This group is rich in species, which are all biologically associated with bees, whose nests they inhabit and who act as transporters of their hypopi. Adult stages are only known in a few cases.

7. Subfamily Chaetodactylinae

Key to the genera

Adults

1(2) Propodosomal shield absent; idiosoma elongated, 1.4 to 1.5

times longer than wide, with a fairly distinct transverse groove; the sternum is well-developed in both sexes; the ends of epimeres III and IV are joined by a fine chitinous line, so that coxal fields III are closed.

21. Chaetodactylus Rond.

2(1) Well-developed propodosomal shield, forming 2 lateral sclerotised bands, which reach the base of legs II and there end in a more or less oval plate; idiosoma very wide (1.1 to 1.3 times longer than wide only), without any trace of transverse grooves; ♂ with a sternum shaped like a V; in the ♀, epimeres I are joined directly to the epigynium; epimeres III and IV are very short and free.

20. Sennertia Ouds.

Hypopi

1(10) Legs IV with a well-developed claw; body elongated (not less than 1.5 times longer than wide), more or less oval, fairly convex; the dorsal shields cover all or almost all the dorsal surface of the body. Species of medium size, often resembling hypopi of the family Saproglyphidae.

2(5) Tarsi IV without macrosetae, but with 2 or 3 small, lanceolate setae; sternum simple (not bifurcated); claws strongly hook-shaped, about the same size on all the legs.

3(4) Sculpturing of the dorsal shields very coarse, composed of round or oval pits, with very distinct edges, so that the shields appear to be perforated; sucking disc square, posterior edge of the hysterosoma strongly curved.

25. Cerophagus Ouds.

Only 1 species: C. granulatus Duj. France, Holland, Germany.

4(3) Sculpturing of the dorsal shields very delicate, composed of fine etched lines, longitudinal on the hysterosoma and oblique and transverse on the propodosoma; sucking disc rounded; posterior

edge of body smoothly curved. 26. Cerophagopsis gen.n.

5(2) Tarsi IV with 1 to 3 macrosetae, without leaf-like setae, or else these are narrowly widened, almost linear; claws feebly curved or twisted into a spiral, in the latter case the claws of legs IV are much smaller than the others; sternum with a bifurcated end.

6(7) Claws of legs I to III very strong, spirally twisted, placed at the end of a well-developed fleshy praetarsus; claws of legs IV much smaller than the others, but similar in shape; legs I and II very strong, much stronger than legs IV; tarsi I to II with 3 strong curved setae; setae of the dorsal surface extremely short and thin. 27. Sennertionyx gen.n.

Only 1 species: S. manicati Giard. France, Andalusia, Italy, Island of Corfu, U.S.S.R. (Odessa, Armenia, Kopetdagh, North West Kazakhstan).

7(6) All the claws of the same size, feebly curved, without fleshy praetarsi; legs IV of about the same size as the remaining legs; tarsi I to III with 4 to 5 widely lanceolate setae.

8(9) Setae of the dorsal surface represented by fine microsetae; sculpturing of the dorsal shields indistinct, similar to that of Cerophagopsis; tarsi I and II with 4 lanceolate setae, tarsi IV only with simple setae. 22. Horstia Ouds.

9(8) Setae of the dorsal surface very long, slightly flattened; sculpturing of the dorsal shields composed of numerous long and rather crescentic pits; tarsi I and II with 5 elongated setae; tarsi IV with 3 narrowly lanceolate setae.

24. Neohorstia gen.n.

10(1) Legs IV without claws.

11(12) Claws I to III simple, fairly small, feebly curved and sessile;

praetarsi absent; body elongated, shaped like a pear or an elongated hexagon, 1.45 to 1.6 times longer than wide. A small species.

23. Tortonia Ouds.

12(11) Claws I to III enormous, strongly twisted into a spiral, placed at the end of a narrow long praetarsus; body very wide, flat, often almost round. Species generally large.

13(14) Two dorsal shields: a triangular propodosomal, and a hysterosomal shaped like an inverted trapezium; basal seta of genua I very long. On bees belonging to the genera Osmia, Anthidium and Megachile.

21. Chaetodactylus Rond.

14(13) Only 1 dorsal shield: a nysterosoma, which reaches its maximum width near the posterior edge of the body and narrows gradually towards its front end; basal seta of genua I short. On bees belonging to the genus Xylocopa.

20. Sennertia Ouds.

20. Genus Sennertia Ouds. 1905.

Oudemans, 1905, Entomol. Ber., II, 21; Vitzthum, 1919, Arch. Naturg., LXXXV, 31.

Type species: Acarus cerambycinus Scop. 1763.

The idiosoma is without a transverse groove, very broad (only 1.5 to 1.3 times longer than its width), pentagonal, and almost the same shape in both sexes; it has sharply protruding scapular regions and a more or less strongly concave posterior edge. The propodosomal shield is well-developed forming 2 long, densely sclerotised strips lying along the side of the body and extending posteriorly as far as the base of legs II; at their hinder ends, these strips (pseudoperitremes) are round or pointed and resemble the so-called peritremes of the Parasitiformes. The setae of the dorsal surface of the idiosoma are fairly short, stiff and rather

densely pectinate. Epimeres III and IV are very short and free. The legs are long and slender, the anterior ones sometimes slightly flattened; the apical seta found on tibiae III and IV is reduced. The praetarsi are feebly developed, narrow and shorter than the claws; in many cases, the latter are very large and sickle-shaped.

♂. The sternum is V-shaped and free; the genital opening lies between the bases of legs II and III; the penis is very large, shaped like a sickle or a sabre; at its base it has 2 very long cylindrical supports, which diverge posteriorly at a right or an obtuse angle; the genital suckers are absent and the anal slit is displaced to the base of the penis.

♀. Epimeres I are fused with the epigynium, so that a rather wide bar connects their ends; the genital opening is placed between the bases of legs II, at a great distance from the anal slit; genital "suckers" are present, but a copulatory tube is absent; tarsi IV are sometimes bent.

The larva has not been seen and, as far as is known, a resting hypopus is not formed.

Migratory hypopus. The body is large (220 to 515μ), strongly flattened and hexagonal or almost round. A propodosomal shield is completely absent, the hysterosomal is much narrower than the body, so that the greater part of the dorsal surface is left bare; in these uncovered areas, the cuticle is soft and membranous and ornamented with sharp, concentric striations; a similar, but less pronounced, pattern covers the surface of the hysterosomal shield; sometimes the latter is rather strongly reduced, so that almost the whole surface of the body may be covered with a soft, striated cuticle; in most species, the posterior edge of the hysterosomal shield is reflected on to the ventral surface of the body and is more or less deeply incised. There are at least 5 pairs of dorsal setae, i.e. sc e, h i, h e, l a and l p, which are very stiff macrosetae; the degree of development of the remaining setae varies, but most of them are usually reduced and represented only by rounded pores; p a are long and, like

sa i, are inserted on the reflected region of the hysterosomal shield and are therefore ventral in position; the setae of the ventral side are very varied in structure. The gnathosoma is completely fused with the idiosoma and the arists are very short. The sternum is simple; epimeres II are straight or slightly curved, they are free and widely diverging at their ends; epimeres III are short, free or else connected with epimerites II; epimeres IV are strongly reduced. The sucking disc is relatively small and devoid of membranous edge; it is sometimes surrounded by an incomplete chitinous frame.

Legs I to III are very strong and rugged, with enormous spirally twisted claws inserted on the ends of long, fleshy praetarsi; the latter are thrown into thick, transverse folds and often bear a more or less well-developed, finger-shaped lateral appendage; tarsi I to III are short, narrowing sharply towards their ends to merge imperceptibly with the praetarsi; each bears 3 long preapical setae, of which the lateral ones are often widened distally into a narrow, crescentic or lanceolate plate. The dorsal chaetotaxy of tarsus I consists of 3 long setae (of which the middle one is straight and rod-shaped), and of a sensory rod and another sensilla of the same kind, which is placed anterior and external to it; this additional sensilla is more distal than the external apical seta and 2 ventral setae. Legs IV are much shorter and thinner than the others, and end in a very strong macroseta, which is usually longer than the body, and 1 or 2 small ventral setae; they have no ambulacra.

This genus is rich in species, which are mainly tropical and biologically connected with wood bees belonging to the subfamily Xylocopinae; in the palearctic region the genus Sennertia contains 9 species, of which 7 are known only in the hypopial stage.

Sennertia Ouds.

Adults

1(2) Sc and the 4 pairs of dorsal setae (d_1 to d_4) are represented

by short, stout microsetae (4 to 6% of the idiosoma); h a, h p and sa e are very thick, resembling strong, curved stalks with blunted ends; cuticle of the dorsal surface densely covered with triangular squamoids; claws large and strong. Algeria.

4. S. cantabrica sp.n.

2(1) Sc e and all the dorsal setae are fairly long (12 to 20% of the length of the idiosoma), slightly pectinate; h a and h p have the same structure; sa e are slightly thicker and straight; cuticle of the dorsal surface very finely grained; claws small. Central and eastern Europe, palearctic region of Asia.

1. S. cerambycina Scop.

Hypopi

1(2) Sc i, l a, l p and d_1 are represented by macrosetae, approximately the same length as sc e (32 to 37% of the length of the body), so that the dorsal surface of the body has 7 pairs of similar setae; d_2 and d_3 are fairly long strong setae, 6 to 15% of the length of the body. On species belonging to the group Xylocopa olivieri Lep. Greece, Turkey, Armenia, Central Asia.

7. S. zhelochovtsevi sp.n.

2(1) Sc i 2 to 4 times shorter than sc e or else represented by minute microsetae; d_1, d_2 and d_3 are very small setae or completely reduced to small round pores; the dorsal surface has 5 to 6 pairs of macrosetae only. On other species of Xylocopa.

3(6) Sc i 8 to 20% of the length of the body, 2 to 4 times shorter than sc e, fairly strong, so that the dorsal surface bears 6 pairs of fairly long setae.

4(5) Setae of the ventral surface of the body strongly thickened, resembling spines; the ventral setae are modified to form a pair of oval organs attached to a short stalk; dorsal setae very strong and

sabre-shaped; sc i twice as short as sc e and 15 to 20% the length of the body; hysterosomal shield very large, almost reaching as far forward as sc i; one of the ventral setae of tibiae I and II and the ventral apical seta of the tarsi is a strong conical spine. On Xylocopa dissimilis Ler. Japan, Assam, Java.

6. S. horrida Vtz.

5(4) All the setae of the ventral surface capilliform; dorsal microsetae fine and flexible; sc i 4 times shorter than sc e, 8 to 10% of the length of the body; hysterosomal shield narrow, reaching as far forward as d_1; all the leg setae fine and flexible. On Xylocopa pictifrons Sm. Sze-tchouan.

8. S. potanini sp.n.

6(3) Sc i represented by very small microsetae, the dorsal surface has only 5 pairs of strong setae.

7(8) Setae of the ventral surface of the body spiniform; praetarsi I to III with a strongly developed digitiform appendage. On Xylocopa kalinovskii Rad. (circumvolans Sm.). China, Korea, Japan.

5. S. alfkeni Ouds.

8(7) Setae of the ventral surface of the body fine and capilliform; praetarsi without an appendage or with a small, blunt process. On other species of Xylocopa.

9(16) L p shorter than sc e or almost the same length; hysterosomal shield large, well-sclerotised and strongly coloured, extending as far forward as d_1 or slightly in front of them; external and posterior suckers very small, the external lateral in position, near the central, well removed from the posterior suckers.

10(11) A large species, 460 to 515μ long; hysterosomal shield 1.5 times longer than its width at the base, gradually narrowing towards its anterior end. On Xylocopa punctilabris F.Mor. and X. valga Gerst.

Tadzhikistan, Turkey. 2. S. gargantua sp.n.

11(10) Smaller species, not more than 340μ long; hysterosomal shield 1.75 to twice as long as wide, with parallel sides and a rather rounded anterior edge.

12(13) Posterior edge of the hysterosomal shield straight, not reflected on to the ventral side of the body, so that sa i and p a are dorsal in position; sucking disc well-removed from the posterior edge of the body; ventral seta of tarsi IV 4 times longer than the tarsi themselves, external ventral seta of tarsi I and II not thickened, setiform; l p 1.5 times shorter than sc e. On Xylocopa cantabrica Lep. Algeria. 4. S. cantabrica sp.n.

13(12) Posterior edge of the hysterosomal shield rounded, strongly reflected on to the ventral side of the body and with a deep cleft, in which is situated the posterior edge of the sucking disc; sa i and p a are ventral; ventral seta of tarsi IV shorter than the tarsus or 1.4 to 1.5 times longer; l p slightly shorter than sc e.

14(15) Hysterosomal shield 1.75 times longer than wide; l a distinctly shorter than sc e; external subapical seta of tarsi I and II capilliform, external apical strongly curved, thickened to resemble a knife; ventral seta of tarsi IV very small, distinctly shorter than the tarsus. Species larger. Length 270 to 330μ. On species belonging to the group Xylocopa violacea L. Central and east Europe, palearctic region of Asia. 1. S. cerambycina Scop.

15(14) Hysterosomal shield narrower, twice as long as wide; l a slightly longer than sc e; external subapical seta of tarsi I and II lanceolate, enlarged, the external apical thin and rod-shaped; ventral seta of tarsi IV appreciably longer than the tarsus itself. Species smaller; length 224 to 255μ. On Xylocopa dissimilis Lep. Japan. 3. S. dissimilis sp.n.

16(9) L p very long, twice as long as sc e; hysterosomal shield very small, not reaching even to d_2, feebly sclerotised and almost colourless, indistinctly separated from the colourless cuticle surrounding it; external and posterior suckers of the sucking disc very small, arranged in a transverse row. On Xylocopa dissimilis Lep. Japan.

9. S. oudemansi sp.n.

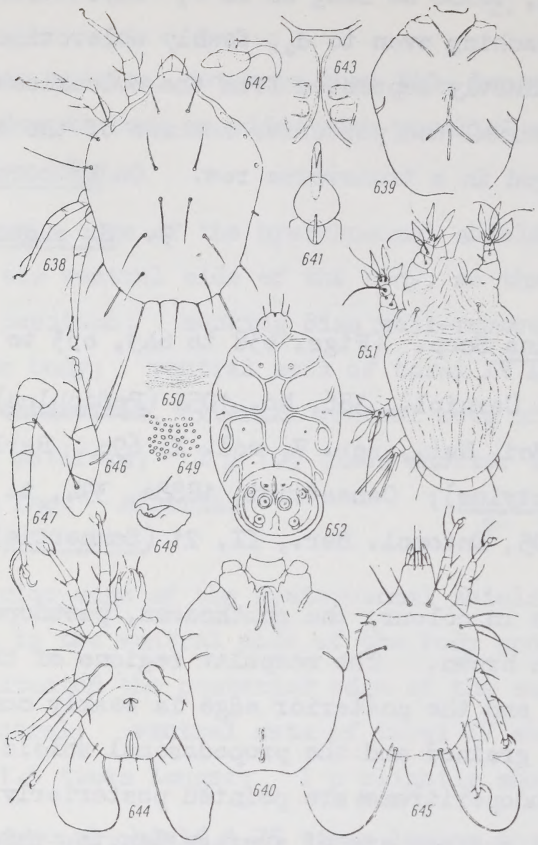
1. Sennertia cerambycina Scop. (Figs. 638 to 643, 653 to 655.)

Scopoli, 1763, Entomol. Carniol., 386, No. 1054 (Pediculus). - xylocopae Donnadieu, 1868; Ann. Sci. Nat., ser. V, vol. X, 69; Berlese, 1885, XVIII, No. 1 (Trichodactylus); Canestrini, 1888a, 394, t. 36 (Trichotarsus); Oudemans, 1905, Entomol. Ber., II, 21 (Sennertia).

This is pale green in colour, the gnathosoma, pseudoperitreme and legs an intense reddish brown. The scapular regions of the idiosoma only protrude slightly and the posterior edge is weakly concave; the cuticle is very finely grained and the propodosomal shield is feebly cuticularised; the pseudoperitremes are pointed posteriorly. The setae arising from the dorsal surface are of average length, thick, tapering, and slightly pectinate, all similar except for l_3, which are thicker than the others, straight and tubular; sc i and h i also differ, being represented by microsetae. The relative lengths of the setae in the ♀ are approximately: v i 9, v p 18, sc e 13, h a 20, h p 30, d_1 20, d_2 22, d_3 18, d_4 16, l_1 18, l_2 15, l_3 14, sa i 55 and sa e 11% of the idiosoma.

The legs are fairly thin, the tibia almost straight; all setae of the legs are thin, flexible and almost smooth; the apical seta of tibiae I and II is short and the apex of each tarsus has a flattened triangular spur on its ventral surface; the claws are relatively small and slender.

♂. The copulatory apparatus is placed between the bases of legs III and IV; the penis is crescentic in shape; the anal slit is very near to the penis and at a considerable distance from the posterior edge of the body.



Figs. 638 - 652

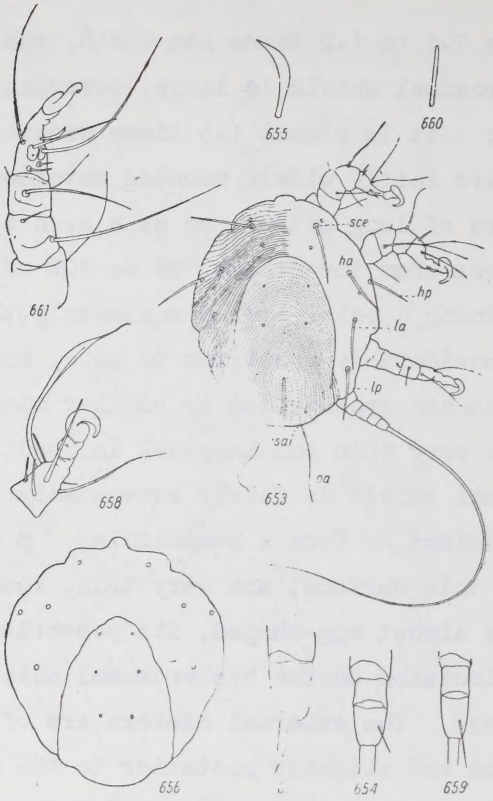
Fig. 638 - Sennertia cerambycina Scop., ♀, dorsal surface (after Berlese). Fig. 639 - S. cerambycina Scop., ♂, ventral surface (after Berlese). Fig. 640 - S. cerambycina Scop., ♀, ventral surface (after Berlese). Fig. 641 - S. cerambycina Scop., end of tarsus and ambulacrum, ventral view (after Berlese). Fig. 642 - Ditto, lateral view (after Berlese). Fig. 643 - S. ceramycina Scop., genital opening, ♀, (after Berlese). Fig. 644 - Chaetodactylus osmiae L. Duf., ♂, dorsal surface (after Michael). Fig. 645 - Ch. osmiae L. Duf., ♀, dorsal surface (after Michael). Fig. 646 - Ch. osmiae L. Duf., leg I (after Michael). Fig. 647 - Ch. osmiae L. Duf., leg IV, (after Michael). Fig. 648 - Ch. osmiae L. Duf., chelicera, lateral view (after Michael). Fig. 649 - Ch. osmiae L. Duf., structure of cuticle, strongly magnified (after Michael). Fig. 650 - Ditto, under a lower magnification (after Michael). Fig. 651 - Horstia ornata Ouds., hypopus, dorsal surface (after Oudemans). Fig. 652 - Ditto, ventral surface (after Oudemans).

♀. Epimeres I are short, joining the wide transverse epigynium at an obtuse angle. The total length of the body is 800μ.

Hypopus. The body is 1.1 to 1.2 times its width, and roundly hexagon in shape. The hysterosomal shield is large, covering the greater part of the dorsal surface; it is almost 1.5 times wider than long, with parallel sides which are fairly widely rounded anteriorly. On the dorsal surface are 5 pairs of long setae: sc e, h e, h i, l a and l p; sc e are slightly longer than the others, 29 to 30% of the length of the body, whilst the remaining 4 pairs are approximately the same length (23 to 26%); sc i are considerably posterior to sc e, and are minute microsetae. All the dorsals are represented by similar microsetae (or by simple pores); sa e are very thin and marginal in position; the posterior edge of the hysterosomal shield is fairly extensively reflected on to the ventral surface and incised to form a semicircle; p a are ventral and like all the setae of this surface, are very thin, resembling hairs. The entire sucking disc is almost egg-shaped, its posterior half fitting into the corresponding incision on the hysterosomal shield; it has no peripheral sclerotised ring; the external suckers are of medium size, they are lateral in position and slightly posterior to the central ones; both posterior suckers are placed on a special sclerite, which has a crescentic outline.

Legs I and II are fairly thick; the ventral setae of the femur and tibia, the external seta of the genu and both marginal preapical setae of the tarsi are thin and hairlike; the external apical seta of the tarsus is sharply bent, thickened and lanceolate, whilst the ventral apical setae are very small and thin. Tarsi IV are feebly separated from the tibiae, becoming noticeably narrower towards the end, the ventral seta of each is very small, considerably shorter than the tarsus itself. Length 270 to 380μ, width 240 to 300μ. The other developmental stages are unknown.

Distribution. The whole of the southern, central and eastern Europe, as far north as latitude 55μ, central Asia as far as Tibet and Gashung and



Figs. 653 - 661. Hypopi of the genus Sennertia

Fig. 653 - Sennertia cerambycina Scop., hypopus, dorsal surface. Fig. 654 - Ditto, end of leg IV (and the base of a macroseta), ventral surface. Fig. 655 - S. cerambycina Scop., external subapical seta of tarsus I. Fig. 656 - S. gargantua, sp.n., hypopus. Fig. 657 - S. gargantua, sp.n., end of leg IV, ventral surface. Fig. 658 - S. dissimilis, sp.n., tarsus I of the hypopus. Fig. 659 - S. dissimilis, sp.n., external subapical seta of tarsus I. Fig. 660 - S. dissimilis, sp.n., end of leg IV, ventral view. Fig. 661 - S. zhelochovtsevi, sp.n., leg I, dorsal surface.

the Gobi desert in the east, and as far as N. Iran in the south.

Ecology. It lives in the nests of Xylocopa sp. belonging to the group violacea: X. violacea L., X. valga F. (including the subspecies pyrrhopyga Fr.), X. varentzovi F.Mor., X. nitidiventris Sm., X. przewalskii F. Mor.; the hypopi were also found on the parasite Polyochrum reprandum sp. and sometimes (accidentally?) on other Hymenoptera: Osmia (Megalosomia) princeps F.Mor., O. (Aceratosmia) macroglossa Gerst., Megachile argentata F. and Anthidium cristofi F.Mor. Adults of S. cerambycina have only been found once up to the present.

2. Sennertia gargantua sp.n. (Figs. 656, 657.)

Hypopus. This is very similar to S. cerambycina, but differs in being much larger. The hysterosomal shield is 1.5 times longer than its greatest width, which is at the posterior end of the body; this gradually narrows towards its anterior end (so that its lateral edges are slightly convex along the entire distance, and noticeably converge at the anterior end); sa i are thickened to form spines; the ventral seta of tarsi IV is only 1.5 times shorter than the combined length of the tibia and tarsus. All other structural details are the same as in S. cerambycina. Length 463 to 515μ, width 390 to 363μ.

Distribution. Usbekistan, Tadzhikistan (Turkey)

Ecology. Hypopi were found on Xylocopa punctilabris F.Mor. and X.valga F.; on the latter they were found with the hypopi of S. cerambycina. Judging from the size of the hypopus, the adult must be very large.

3. Sennertia dissimilis sp.n. (Figs. 658 to 660, 665.)

Hypopus. This is very similar to that of S. cerambycina, but it is smaller and narrower. The body is 1.23 to 1.3 times longer than wide, the hysterosomal shield being correspondingly narrower than that of S. cerambycina, twice as long as wide, with parallel sides and a rather

widely rounded anterior edge; the longer body setae are slightly shorter (sc e 25, h e, l p and h i 21 to 28, l a 26% of the length of the body); l a are noticeably longer than l p and both humerals are even slightly longer than sc e; the external suckers (relative to the central ones) are much displaced posteriorly and are slightly longer. The legs are more slender; the external subapical seta of tarsi I and II is broadened like a lance in its distal half and the external apical seta of the same tarsi is straight, thin and of even diameter; tibio-tarsus IV is almost 2.5 times longer than its diameter and only 1.25 times longer than the seta which arises from its ventral side. Length 245 to 255μ, width 180 to 260μ.

Distribution. Japan, where it was found on Xylocopa dissimilis Lep., together with S. horrida, S. oudemansi and Horstia helenae. I have not found any hypopi of S. dissimilis on specimens of X. dissimilis from Assama.

4. Sennertia cantabrica sp.n. (Figs. 23, 662 to 664.)

Telonymph. The idiosoma has a very sharply protruding shoulder region and a fairly concave anterior edge; the cuticle of the dorsal surface is thickly covered with triangular scales or squamoids; the propodosomal shield is feebly sclerotised and the ends of the pseudoperitrome are rounded posteriorly. The majority of the dorsal setae of the idiosoma, i.e. v i, both pairs of sc, h i and all 4 pairs of dorsals, are represented by thick, almost spine-shaped microsetae; h e, sh and sa e are strongly thickened, curved and truncate, they are slightly serrated ventrally; sa i are straight, shaped like rods and clearly pectinate; the relative lengths of the setae are v a 13, v p 4, sc e and sc i 6, h i 4, h e 20, sh 25, d_1 to d_4 4 to 5, l_1 5, l_2 20, sa e 12, sa i about 70% of the length of the idiosoma

The legs are fairly thick, the tibiae slightly bent; the basal and external setae of genua I and II and the ventral seta of genu III are

broad and thickly pectinate; the apical seta of tibiae I and II is fairly long and the ends of the tarsi have no plate-like spurs on their ventral sides; the claws are very large and massive. Length of a freshly moulted specimen is 290μ, width about 250μ.

Hypopus. This resembles the hypopi of the 2 previous species. The hysterosomal shield is narrow (twice as long as wide), with parallel sides and a rounded anterior edge; h e are longer than any of the other longer body setae (about 27% of its length); l p are relatively very short (15%); the posterior edge of the hysterosomal shield is straight and is not reflected on to the ventral surface, so that sa i and p a are dorsal in position; the sucking disc is strongly displaced away from the posterior edge of the body, and its structure is closely similar to that of S. cerambycina. Both preapical setae of tarsi I and II are thin and resemble hairs and the external apical seta is unthickened; the basal parts of praetarsi I to III are thinner than those of S. cerambycina, without lateral projections; tibio-tarsus IV becomes slightly narrower towards the end and is twice as long as its diameter at the base; its ventral seta is long, twice as long as the tibio-tarsus itself. Length 340μ, width 285μ.

Distribution. Algeria (the exact locality is not known). It is associated biologically with Xylocopa cantabrica Lep., on which the exuvium of the hypopus has been found, and also one newly-emerged telonymph of this species.

5. Sennertia alfkeni Ouds. (Figs. 672 to 674.)

Oudemans, 1901, Tijdschr. Entomol. XLIII, 115, t. 5, Figs. 18 to 20 (Trichotarsus). - japonicus Odms. 1901, ibid. 146, t. 5, Fig. 21 (Trichotarsus).

Hypopus. This is intensely coloured. The hysterosomal shield is the same shape and size as that of S. cerambycina; sc e, h e, h i, l a and

l p are very long, thick, slightly blunted at the end and strongly pigmented; sc e are 37 to 55; h i 30 to 37, h e 22 to 27, l a 33 to 47, l p 40 to 47% of the length of the idiosoma; p a are also very long, 60 to 65% the length of the body and noticeably thickened; all the other setae of the dorsal surface of the idiosoma are reduced and represented by pore-like formations; p a are very short, and sa i are ventral, arising from the reflected portion of the dorsal surface of the shield; the coxal and genital setae of the ventral side are strongly thickened in their basal half, and the distal end of each produced into an elongated, flexible spine. The sucking disc is small, with no sclerotised frame, and the external suckers are strongly displaced posteriorly, so as to form, with the posterior ones, an arc-shaped row, whose convex surface points towards the hind end of the body; the posterior suckers are barely smaller than the external ones, which project from a distinct crescentic sclerite.

Legs I to III are very thick; the external basal seta of genua I and II is much hypertrophied, very stiff and dark in colour; the external and internal preapical setae of the tarsi are simple or lanceolate; the external apical seta is thickened and sharply bent, whilst the ventral apical setae are also slightly thickened; the praetarsi have very well-developed digitiform lateral protrusions. Tarsi IV are quite distinct from the tibiae, and only slightly expanded distally; the ventral seta is very long (as long as legs IV). Length 195 to 325μ, width 165 to 270μ.

Distribution. Japan, Korea, China. The hypopi were found in large numbers on Xylocopa kalinovskii Rad.

This species is conspicuous on account of the great variation in size, the length of the body setae and the degree of leaf-shaped widening of the preapical setae of legs I to III. On the last character Oudemans distinguished 2 independent species: S. alfkeni - with hair-like preapical leg setae, and S. japonica - with lanceolate setae. Investigation of a large quantity of material made it possible to establish

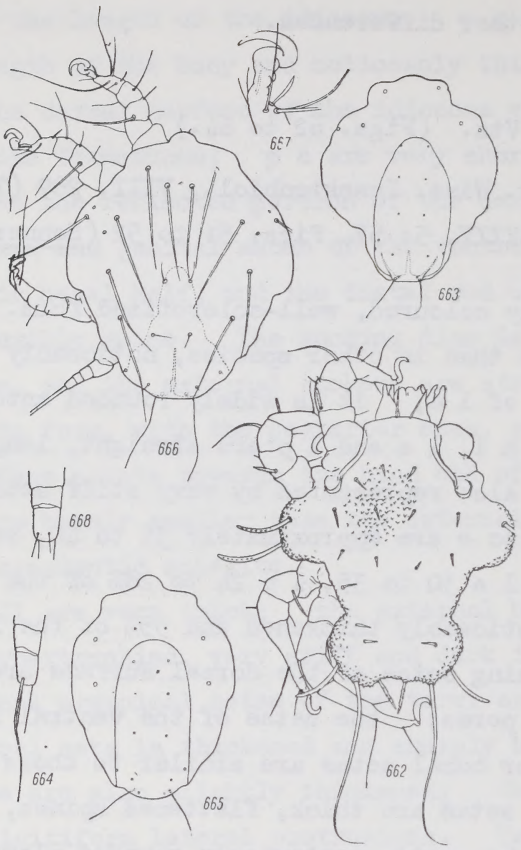
that both forms could be found at the same time in sample populations, together with intervening stages, and these characters were not found to be connected with other differences.

6. Sennertia horrida Vtz. (Figs. 62 to 64.)

Vitzthum, 1912, Ztschr. Wiss. Insektenbiol., VIII, 289 (Trichotarsus); 1919, Arch. Naturg., LXXXV, 5: 57, Figs. 51 to 52 (Sennertia).

Hypopus. An intensely coloured, well-sclerotised form. The hysterosomal shield is larger than in other species, noticeably widening anteriorly up to the level of l a; it is widely rounded anteriorly or slightly angular; sc e, h e, h i, l a and l p are straight, long and strongly pigmented; sc i are also represented by very stiff setae, but are half the length of sc e; sc e are approximately 35 to 40, sc i 18 to 20, h i 40, h e 15 to 20, l a 30 to 35, l p 24 to 28% of the length of the idiosoma; p a are noticeably thickened and 55% of the length of the body; all the remaining setae of the dorsal surface are strongly reduced and represented by pores; the setae of the ventral surface are much modified: the anterior coxal setae are similar to those of S. alfkeni, sh and the post-coxal setae are thick, flattened spines, and the ventral setae are represented by ovoid, posteriorly rounded plates, which are inserted on a short stalk; the anterior genital setae are microsetae. The sucking disc is rounded, with a chitinised frame whose anterior edge is almost closed, and a pair of linear sclerites, which extend diagonally away from the lateral suckers; the lateral and posterior suckers are well-separated from the central ones, they are arranged in an anteriorly convex arc and resemble large pear-shaped structures.

Legs I and II are massive; the apical and lateral setae of the genu, the external ventral seta of the tibia, the sensory rod and sensilla adjacent to it, and the ventral apical setae of the tarsi are modified into rather thick, sharp spines (the central apical seta of tarsus I is more massive than the others); the external and internal preapical setae of



Figs.662 - 668

Fig.662 - Sennertia cantabrica, sp.n., telonymph. Fig.663 - S. cantabrica, sp.n., hypopus, outline of body and hysterosomal shield. Fig.664 - S. cantabrica, sp.n., hypopus, distal part of leg IV, ventral surface. Fig.665 - S. dissimilis, sp.n., hypopus, outline of body and hysterosomal shield. Fig. 666 - S. zhelochovtsevi, sp.n., hypopus, dorsal surface. Fig. 667 - Ditto, end of tarsus I, lateral view. Fig.668 - Ditto, end of leg IV, ventral view.

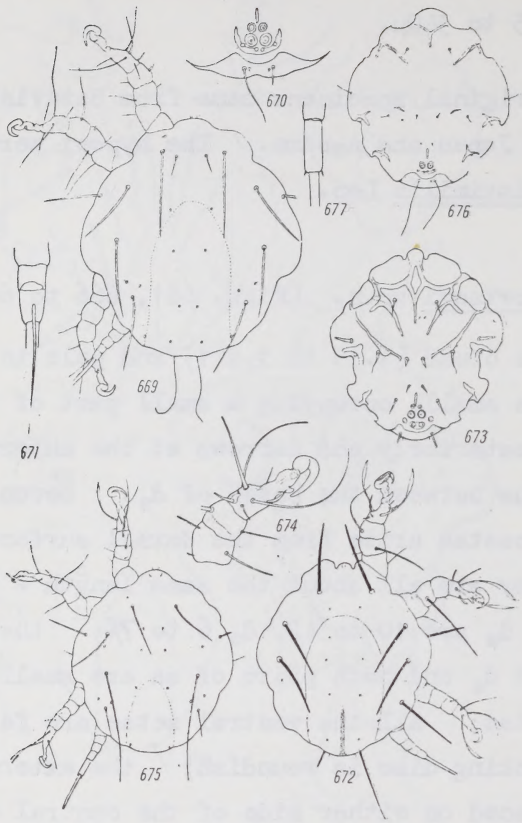
tarsi I and III are large, and broadened into a lanceolate plate distally. Tarsi IV become narrow towards their distal ends and have a very long, strong ventral seta (exceeding the length of legs IV). Length 265 to 430μ, width 205 to 340μ.

Distribution. The original specimens came from Batavia (Java); I have seen others from Japan and Assama. The hypopi were found in large numbers on Xylocopa dissimilis Lep.

7. Sennertia zhelochovtzevi sp.n. (Figs. 661, 666 to 668.)

Hypopus. The body is broad (1.15 to 1.2:1) and pale in colour. The hysterosomal shield is small, occupying a small part of the dorsal surface; it is broad posteriorly and narrows at the anterior end to project as a narrow tongue between the bases of d_2. Seven pairs of very long and similar macrosetae arise from the dorsal surface: sc e, sc i, d_1, l a and l p; they are all about the same length - 32 to 50% of the length of the body; d_2 are 10 to 12, d_3 6 to 7%; these are all fairly stout setae, whilst d_4 and both pairs of sa are small and thin, although well-defined, microsetae; all the ventral setae are fairly long and capilliform. The sucking disc is roundish; the external suckers are medium in size and placed on either side of the central ones (on the same transverse line), and arise from small separate sclerotised regions; the posterior suckers equal the external and also arise from a separate semicircular plate; both these pairs of suckers are close to the central ones.

Legs I and II are of medium width; the ventral setae of the femur and tibia, the external setae of the genua and both lateral subapical setae of the tarsi are very long, thin and capilliform; the external apical seta of the tarsi is almost straight, slightly lanceolate. Praetarsi I to III have no lateral projections; tarsi IV are slightly longer than 1.5 times their width at the base, becoming narrower towards their distal ends and with 2 very small ventral setae. Length 375 to 460μ,



Figs. 669 - 677

Fig. 669 - Sennertia potanini, sp.n., hypopus, dorsal surface. Fig. 670 - S. potanini, sp.n., hypopus, posterior end of body and sucking disc. Fig. 671 - S. potanini, sp.n., hypopus, end of leg IV, ventral view. Fig. 672 - S. aljkeni Ouds., hypopus, dorsal surface. Fig. 673 - Ditto, ventral surface. Fig. 674 - Ditto, genu, tibia and tarsus I, lateral view. Fig. 675 - S. oudemansi, sp.n., hypopus, dorsal surface. Fig. 676 - Ditto, ventral surface. Fig. 677 - Ditto, end of leg IV (tarsus and part of tibia).

width 324 to 390μ.

Distribution. Greece, Turkey, Armenia and the republics of Central Asia. It was found on Xylocopa olivieri Lep. and other species allied to X.rufa F. The specimens from the region beyond the Caucasus and Greece are, on an average, smaller than those from Buharia, and the dorsal microsetae are usually slightly longer; it is possible that these should be considered as a separate subspecies.

8. Sennertia potanini sp.n. (Figs. 669 to 671.)

Hypopus. The body is very broad (1.1:1) and faintly coloured. The hysterosomal shield is narrow and tongue-shaped, becoming broader towards the posterior end of the body. Arising from the dorsal surface are 5 pairs of long and 1 pair of medium length (sc i) setae; sc e are noticeably longer (37 to 42% of the length of the body); sc i are one-quarter the length of sc e; all the setae of the ventral surface are thin and capilliform. The sucking disc is small, surrounded posteriorly and laterally by a somewhat angular semicircle, from which project the minute external and lateral suckers.

Legs I and II are relatively slender; the ventral setae of the femur and tibia and the external setae of the genua are thin and fairly short; both lateral and subapical setae of the tarsi resemble hairs and the external apical seta is thickened and slightly bent and lanceolate in shape. Praetarsi I to III have no lateral projections. Tarsi IV are 1.5 times longer than their diameter at the base, becoming noticeably thinner towards their distal ends, with a long ventral seta (3.5 times longer than the tarsus). Length 370 to 415μ, width 350 to 366μ.

Distribution. West China, Sichuan, Jachdjog. It is biologically connected with X. pictifrons Sm.

9. Sennertia oudemansi sp.n. (Figs. 675 to 677.)

Hypopus. The body is almost round (1.1:1). The hysterosomal shield is

very small, feebly cuticularised, almost colourless and indistinctly separated from the surrounding soft cuticle; it has a smooth, curved outline and only extends as far forward as d_3; there are 5 pairs of long setae on the dorsal surface, all relatively thin; sc e and h i are equal in length, whilst l a are extremely long, twice as long as l p and noticeably exceed half the length of the body (56%); l p are shorter than all the other macrosetae, 27% of the length of the body; all the remaining dorsal setae are very small microsetae or simple pores; all the setae of the ventral surface are very short and thin. The sucking disc is very small, with no sclerotised ring; the external and posterior suckers are very small and form a slightly arched transverse row on the same narrow sclerotised region.

Legs I and II are fairly slender; the ventral setae of the femur and tibia and the external setae of the genua are thin and very short; the external preapical seta is lanceolate and the external apical is thin and capilliform. Praetarsi I to III are narrow and have no lateral projections. Tarsi IV are cylindrical, 3 times longer than their diameter, with 2 very small microsetae at the apex (lateral to the base of the external seta), without a seta on the ventral surface. Length 303µ, width 467µ.

Distribution. Japan, associated with Xylocopa dissimilis Lep., together with S. horrida and S. dissimilis.

21. Genus Chaetodactylus Rond.

Rondani, 1866, Giorn. Agric. Industr. Ital., (3), V, 12. - Trichodactylus L. Dufour, 1839, Ann. Sci. Nat., ser. II, vol. XI, 276 (nom. praeoccup.); Gervais, 1844, in: Walckenaer, Hist. Nat. Ins. Apt. III, 266; Donnadieu, 1868, Ann. Sci. Nat., sér. V, vol. X, 69. - Trichotarsus Canestrini, 1888, 7; 1888a, 356; Berlese, 1897, 105; Kramer, 1899, 148; Oudemans, 1900, Tijdschr. Entomol., XVIII, 115 (part.); 1905, Entomol. Ber., II, 21;

1911, ibid., III, 166; Vitzthum, 1919, Arch. Naturg., LXXXV, 5: 31.

Type species: Trichodactylus osmiae Duj. 1839 (hypopus).

The idiosoma is narrower than in allied genera (1.4 to 1.5 times longer than its width), approximately hexagonal, with fairly clearly defined scapular protrusions and with a slightly concave posterior edge. The cuticle is covered thickly with fine transverse striations, formed of rows of very small blunt projections; the setae of the dorsal surface of the idiosoma are of medium length (some may be reduced in length), feebly pectinate or serrated; v p are absent and sa are smooth, longer than all the other setae of the idiosoma. Epimeres I join at an acute angle to form a well-developed sternum; epimerites II are indistinct or even absent; the ends of epimeres III and IV are joined with a thin chitinous line, so that coxal fields III are closed. Secondary sexual differences in the structure of the coxal-sternal skeleton are slight. The praetarsi are fairly wide, approximately equal in length to the claw.

♂. The sternum is simple; the genital opening is placed between the bases of legs IV or even posterior to them, and the epiandrium is well-developed to form a small sclerotised arc, thickened at both ends.

♀. The posterior end of the sternum is widened to form a crescentic plate, whose pointed ends are directed posteriorly (this probably represents the epigynium); the position of the genital opening has not been established.

The nymphs differ from the adults in having a more sharply defined idiosoma, this is produced into rounded lobes at the edges and the setae arising from the dorsal surface are more uniform in length. In the 2 species whose biology is known (C. osmiae Duj. and C. ludwigi Trouessart), there are migratory as well as inert hypopi.

Migratory hypopus. The body is broad and strongly flattened dorso-ventrally, it is hexagonally round and usually fairly large (up to 450μ).

The dorsal shields are narrower than the body, so that a wide peripheral area of striated skin is left exposed; the propodosomal shield is triangular and separated by a fairly wide space from the long trapezoid hysterosomal shield, this narrows posteriorly and its hind edge is reflected on to the ventral side of the body to form 2 or 3 more or less anteriorly projecting folds, separated by a deep incision; the surface of the dorsal shields is covered with a dense sculpturing of narrow lanceolate indentations, these run transversely on the propodosomal shield and longitudinally on the hysterosomal; the space between the grooves is densely pitted. Some of the setae of the dorsal surface (sc e, h a, h p, and sometimes sc i, l a and l p) are pointed, medium in length, or else short and thin; p a are fairly short and arise from the ventral reflected portion of the hysterosomal shield. The setae arising from the ventral surface vary in structure. The gnathosoma is usually represented by a pair of rounded or pear-shaped plates, bearing a pair of short arists. In most cases, the sternum is simple (only in C. claviger is it bifurcated); the remaining part of the coxal-sternal skeleton resembles on the whole, that of Sennertia. The sucking disc is small, without a free membranous edge.

Legs I to III are very strong, rugged in appearance, with enormous spirally-twisted claws placed on the end of long, fleshy and folded praetarsi; tarsi I to III are short, abruptly narrowing distally to merge with the praetarsi; legs IV are usually more feebly-developed than legs I to III and end in a long macroseta and 2 shorter setae; an ambulacrum is absent. The chaetotaxy of tarsus I is the same as that of Sennertia.

In addition to the 6 palearctic species described here, the genus Chaetodactylus also includes Ch. ludwigi Trouessart 1897 from the Caroline Islands, and several more non-arctic species which are not described here.

Chaetodactylus Rond.

1(2) Sternal setae modified into strong, oval spines, the ventral

setae are conical and strongly thickened; sternum bifurcated at its end; legs I and II very strong; the distal end of each tarsus has a strong recurved spine on its ventral side; tarsi IV with 3 very long setae. Large species. Length 370 to 450μ. On Osmia (Ceratosmia) tricornis Latr. Italy.

4. Ch. claviger Ouds.

2(1) Sternal and ventral setae very fine, capilliform; sternum simple; legs I and II not thickened, with no spine at the end of each tarsus; tarsi IV with 1 very large macroseta and 2 much shorter and finer setae (sometimes these are even microsetae). Body does not exceed 375μ in length.

3(8) External suckers lateral in position, near the centrals (forming with these a transverse row), well in front of the posteriors.

4(5) Sc i strong, the same length and thickness as sc e and h i, placed on the same level as the 2 pairs of humerals (h i and h e); d_3, sa e and sa i very rigid, pointed; internal apical seta of tarsi IV 3 times longer than the whole of leg IV and the external ventral seta. On Chelostoma florisomnis L. U.S.S.R. (near Kirov: Lavy).

3. Ch. birulai sp.n.

5(4) Sc i much shorter and thinner than h and sc e, arising well anterior to a line joining the humeral setae; d_3, sa e and sa i thin, flexible; internal apical seta of tarsi IV not more than twice as long as leg IV and the external apical seta. On species of the genus Osmia.

6(7) Internal apical seta of tarsi IV much shorter than legs IV and rather longer than the external; sc e shorter (10 to 11% of the length of the body), only 1.5 times longer than sc i; internal subapical seta of tarsi I to III, as well as the external of tarsi III, very slightly enlarged (narrowly lanceolate). England, France, Italy Roumania, U.S.S.R. (near Sarepta and Tbilisi).

1. Ch. osmiae Duj.

7(6) Internal apical seta of tarsi IV twice as long as legs IV and the external apical seta; sc e longer (almost 20% of the length of the body), 3 to 4 times longer than sc i; internal subapical seta of tarsi I to III and the external of tarsi III strongly enlarged and lanceolate. Germany, U.S.S.R. (Georgia, the Crimea).

2. Ch. réaumuri Ouds.

8(3) External suckers posterior to the centrals, on the same level as the posterior suckers.

9(10) Larger species; almost 350μ long; dorsal shield light brown in colour and covered with pits or numerous longitudinal depressions; sucking disc longer than wide. On Anthidium sticticum F. Tunisia.

5. Ch. anthidii Ouds.

10(9) Smaller species; 215 to 310μ long; dorsal shield not coloured, with a delicate reticulate pattern; sucking disc slightly wider than long. On species of Megachile and on wasps Pseudovespa germanica L. U.S.S.R. (Leningrad, Ouglitch, Oustj-Kamenogorsk, Ak-tasch, near Taschkent).

6. Ch. dermentjevi sp.n.

1. Chaetodactylus osmiae Duj. (Figs. 78, 79, 644 to 650, 678.)

L. Dufour, 1839, Ann. Sci. Nat., ser. II, vol. XI, 276, t. VIII, Fig. 3; Donnadieu, 1868, ibid. sér. V, vol. X, 69, (Trichodactylus); Canestrini, 1888a, 394; Berlese, 1897, 105; Kramer, 1899, 149; Michael, 1903, 17, t. XXII, XXXIX, Figs. 13 to 15 (Trichotarsus).

Biology: Trouessart, 1904, C.R. Soc. Biol., LVI, 241, 355; Popovici-Baznoseanu, 1913, Arch. Zool., LII, Notes et Revue, 33.

In life, this is pale yellow in colour, the colour being more noticeable on the front and sides of the idiosoma; the gnathosoma and legs are a light red. The idiosoma is 1.4 to 1.5 times longer than its width.

V a arise near the anterior edge of the idiosoma, d_2 and d_3 are strongly reduced or absent; the approximate lengths of the setae in the ♀ are: v a and sc i 24 to 25, sc e 22, h a and sh 26 to 28, h p 33, d_1 30, d_4 22, l_1 33 to 35, l_2 22, l_3 15 to 17, sa e about 100% of the length of the idiosoma. The leg setae are smooth. The dorsal apical seta of the tarsi is very long, especially on legs III and IV. The claws are of medium size. Total length of the body of the ♂ about 450µ, width 270µ; length of ♀ 500µ, width 320µ.

Hypopus. The dorsal shields are dense and strongly pigmented, with a typical indented and pitted sculpturing; the anterior angles of the hysterosomal shield are usually drawn out in the form of narrow triangular protrusions. The setae of the dorsal surface are fairly short; sc e, h i and h e are stiffer, longer and thicker than the other setae; sc e are 1.5 times longer than sc i, which are slightly anterior to a line drawn through the bases of h e, the latter are approximately equal in length to sc e (10 to 11% of the length of the idiosoma) and considerably longer than h i (8 to 9%); all the remaining dorsal setae are 3 to 5% and fairly thin and flexible; the ventral setae are thin and capilliform. The coxal-sternal skeleton is moderately well-developed, the sternum simple. The incised region of the hysterosomal shield, which is reflected on to the ventral surface, has a well-developed medial protrusion. The lateral suckers are placed on the same transverse line as the central ones, the posterior are equal in size to the lateral suckers and project from an oval sclerotised surface, this is separated by a wide distance from the lateral sclerites (which bear the lateral suckers); the anterior ends of these sclerites are prolonged into crescentic protrusions.

Legs I to III are of medium thickness and armed with long flexible setae; the dorsal apical seta of the genu is shorter than the tibia, the subapical setae of the tarsi are not broadened distally; the external seta of genu III is very long. Legs IV are thin, much shorter than the others and ending in 1 very long macroseta and 2 shorter ones, of these

the internal is much shorter than the external, and the latter is considerably shorter than legs IV. Length 280 to 375μ, width 220 to 290μ.

Inert hypopus (resting hypopus according to Trouessart). This is widely ellipsoid in shape, resembling those found in the genus Glycyphagus. Legs I and II are conical and clearly segmented; legs III and IV are represented by ring-shaped formations resembling suckers. There is no trace of sucking disc or genital suckers.

Distribution. France, Italy, England, Roumania, U.S.S.R.; in the last country it has only been found near Sarepta and in Georgia (Tbilisi).

Ecology. It lives in nests of Osmia (Ceratosmia) rufa L., O. (C.) tricornis Latr. and O. kohli Ducke, feeding on the stores of pollen. Michael was successful in rearing the adult from the nymph by feeding them on old beeswax.

2. Chaetodactylus réaumuri Ouds. (Fig. 679.)

Oudemans, 1905, Tijdschr. Entomol. XLVIII: XXXI (Trichotarsus).

Hypopus. In its general appearance and size, it closely resembles that of Ch. osmiae. Sc e are much longer (18 to 20% of the length of the body); sc i are 3 to 4 times shorter than sc e and very thin; h are 15 to 17%, l a and l p are somewhat thicker than in Ch. osmiae; all the dorsals are thin microsetae 4 to 5% in length. The anterior and posterior suckers are smaller (their diameter equal to half the diameter of the sclerotised frame of the ventral suckers); the posterior suckers project from 2 separate chitinous plates, lying close to each other; the projection from the lateral sclerites of the sucking disc, which are directed anteriorly, are longer and thinner. The internal subapical seta of tarsi I and II and both lateral subapical setae of tarsi III are clearly lanceolate; the external seta of genu III is short and the internal apical seta of tarsus IV is long, twice as long as legs IV and the external

apical seta. Length 275 to 375μ, width 210 to 315μ.

Other stages of development are unknown.

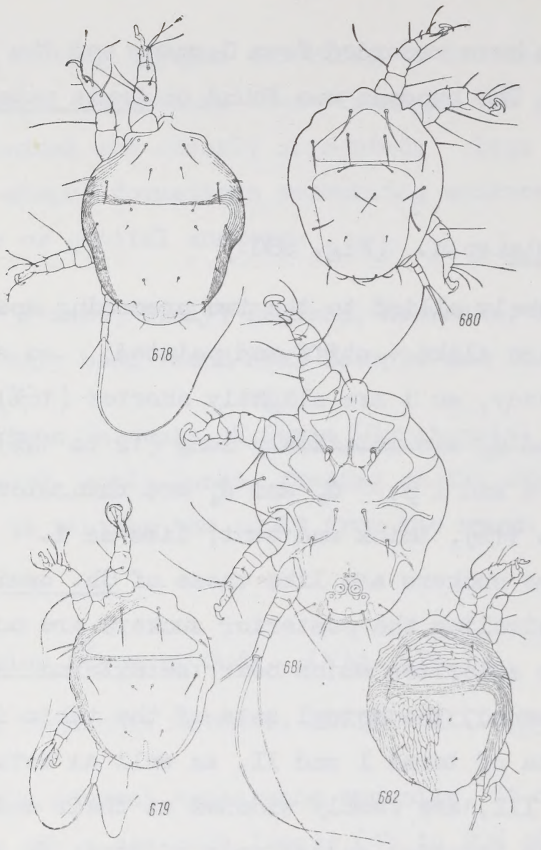
Distribution. It has been recorded from Germany and the Crimea (Artek) and Georgia (Tbilis). The hypopus was found on Osmia panzeri F.Mor and O. leucogastra F.Mor.

3. Chaetodactylus birulai sp.n. (Fig. 680.)

Hypopus. This is closely allied to the two preceding species. Almost all the dorsal setae are alike - stiff and pointed; sc e are 18 to 20% of the length of the body, sc i are slightly shorter (16%), but of the same thickness; d_1 and d_2 are relatively long (12 to 14%), of the same length and width as l a and l p; d_3 and d_4 are thin microsetae; sa e are fairly long (10 to 11%), thick and bent, like sa i. In position and relative sizes, the suckers are like those of Ch. osmiae, but the sclerotised plates encircling the posterior suckers are not distinct from the lateral crescentic sclerites which bear the external suckers. Legs I and II are not thickened, the apical seta of the tibia is short, the external subapical seta of tarsi I and II, as well as both lateral subapical setae of tarsi III, are feebly widened at their ends to form lanceolate setae; the internal apical seta of tarsi IV is 3 times longer than the external seta and the whole of leg IV. Length 290 to 335μ, width 230 to 265μ. The other developmental stages are unknown.

Distribution. Up to the present, it has only been found in the Kirovsk region.

Ecology. Hypopi were collected in large numbers from 1 specimen of Chelostoma florisomnis L. When I was sorting out a series of specimens of this species from the Z. inst. of Acad. of Sc. of U.S.S.R., I did not find any hypopi of Ch. birulai.



Figs. 678 - 682

Fig. 678 - Chaetodactylus osmiae L. Duf., hypopus, dorsal surface. Fig. 679 - Ch. réaumuri Ouds., hypopus, dorsal surface. Fig. 680 - Ch. birulai sp.n., hypopus, dorsal surface. Fig. 681 - Ch. claviger Ouds., hypopus, ventral surface. Fig. 682 - Ch. dimentjevi, sp.n., hypopus, dorsal surface.

4. Chaetodactylus claviger Ouds. (Fig. 681.)

Oudemans, 1928, Entomol. Ber. VII, 328.

Hypopus. This is easily distinguished from all other species on account of its large size and the peculiar hard plating of the ventral surface of the body and legs. The dorsal shields are dense, fairly strongly pigmented, with a typical indented and pitted sculpturing; the anterior angles of the hysterosomal shield are rounded. The setae of the dorsal surface of the body are longer than in other species, stiff and pointed; sc e and sc i are equal in length, approximately 21 to 22% of the length of the body; sc i are considerably anterior to a line drawn through the bases of h i; the latter are slightly longer than sc e (23 to 24%); d_1 are relatively long (15 to 17%), l a, l p and d_2 are about the same length (12 to 13%), whilst d_3, sa e and sa i are noticeably thinner and shorter than all the other setae of the dorsal surface. The setae arising from the ventral surface are strongly modified: the sternal are converted into large, massive, ovoid structures, arising from a short "stalk", the ventral ones are conically thickened towards the base and are shaped like spines; sh and p a are also much thicker than in other species. The coxal-sternal skeleton is very massive; the sternum is bifurcated at the end and the ends of epimeres III are also divided in the same way, the short internal prongs of the fork almost touching the fork of the sternum, the long external ones are bent posteriorly and laterally in the form of arcs; epimerites II, epimeres III and IV and the lateral thickenings of the coxal fields are much more massive than in other species of this genus. The incision on the posterior reflected edge of the hysterosomal shield, almost forms a right angle and is without a medial protrusion; the anterior and posterior suckers are very small and arranged in an almost straight transverse row behind the central ones, they all arise from the same undivided sclerotised plate, which has a peculiar shape.

Legs I and II are extremely thick, the setae arising from them being more massive than in other species; the ventral setae of the femur are

short; the dorsal apical seta of the genu is equal in length to the tibia of the same limb; the external and internal preapical setae of the tarsi are hardly widened and the apex of the tarsus has a very large, slightly bent spine; the external seta of genu III is very long. Legs IV are more strongly developed than in the preceding species, they are no shorter than legs III (excluding the ambulacra) and sufficiently massive, terminating in 3 very long macrosetae, the internal one being less than 1.5 times shorter than the middle and only slightly longer than the external. Length 370 to 450μ, width 290 to 350μ. Other stages are not known.

Distribution. Italy; it has only been recorded from Osmia (Ceratosmia) tricornis Latr., sometimes with Ch. osmiae.

5. Chaetodactylus anthidii Ouds.

Oudemans, 1911, Entomol. Ber., III, 165 (Trichotarsus).

Hypopus. I have not found this myself. It is allied to Ch. osmiae and Ch. réaumuri, but differs as follows: tarsi I and II bear only 1 ventral seta which, with difficulty, can be seen to be lanceolate; it is light brown in colour and the posterior shield is covered (like the aforementioned species) with thousands of bean-shaped indentations. The suckers are differently arranged on their surrounding plate; anteriorly there are 2 small ones, then 2 large ones, succeeded by 4 small ones (in the other species: 2, 4, 2); in addition, the plate is longer than wide. Length 350μ (according to Oudemans).

Distribution. Tunis, on Anthidium sticticum F.; when I examined specimens of this bee from French Morocco and Spain, I did not find any hypopi.

6. Chaetodactylus dementjevi sp.n. (Fig. 682.)

Hypopus. A small form, very pale in colour, the dorsal shields are soft,

almost unpigmented, with a faint design of undulating indented lines, sometimes anastomosing with each other and forming irregular loops. The setae of the dorsal surface are fairly short and thin; sc e are 15 to 16% of the idiosoma in length, 3 to 4 times longer than sc i and shaped like thin macrosetae; both pairs of humerals are of equal length (14 to 16%), whilst l a and l p are noticeably shorter than sc (10 to 13%); all the remaining setae are thin, flexible microsetae, 3 to 4% of the body in length; the ventral setae are thin and resemble hairs. The coxal-sternal skeleton is feebly developed, the sternum simple; the edge of the hysterosomal shield, which is reflected on to the ventral surface, is almost straight; the posterior and lateral suckers are very small, arranged in a straight transverse row behind the central ones.

Legs I and II are moderately thick, almost all their setae being thin and flexible; the ventral setae of the femur are long; both subapical setae of legs I to III resemble hairs; legs IV are short and very slender, ending in 1 long macroseta and 2 microsetae arising on either side of its base. Length 215 to 310µ, width 170 to 275µ. The other immature stages are unknown.

Distribution. I have found it near Leningrad (Pargolovo), Ouglitch, Oustj-kamenogorsk and the Aktash Mountains near Taschkent. The hypopi were found mainly on Megachile bombycina Rad. and M. ligniseca Kl.; 1 specimen was also found on the wasp Pseudovespa germanica L. (Aktasch).

22. Genus Horstia Ouds.

Oudemans, 1905, Entomol. Ber., II, 21.

Type species: Trichotarsus ornatus Ouds. 1900.

The adult is only known in 1 species: H. trifilis Can. 1897 from New Guinea and has only been very superficially described, it evidently resembles the genus Sennertia very closely, but differs in lacking genital "suckers" in the ♀ and in the greater length of the genital opening.

Hypopus. The idiosoma is elongated, 1.4 to 1.6 times longer than wide, approximately egg-shaped and moderately convex; the dorsal shields cover almost the whole of the dorsal surface, but are not reflected on to the ventral side; they are fairly densely sclerotised and covered with a faint pattern of partly anastomosing and indented lines. The setae of the dorsal surface are microsetae and difficult to see (in H. pulcherrima Vtz. 1912 from Venezuela, they are well-developed and some are even long). The gnathosoma is only partially separated from the idiosoma and is a rounded protrusion. The sternum is forked at its posterior end, the prongs often fusing with epimeres II, so as to close coxal fields II; coxal fields III and IV are usually closed owing to the fusion of the ends of epimeres II with epimerites II, and epimeres III with epimeres IV, and in such cases they are separated along the mid-line of the body by the elongated ventral field which they surround. In a number of species, all these epimeres are free, and the coxal fields are therefore open. The coxal and genital setae are reduced and represented by small circles. In most cases, the sucking disc is large, with a very broad membranous edge, which projects well beyond the edge of the idiosoma; it has 3 pairs of large suckers.

The legs are very short, massive and almost conical, all with very short, almost straight claws; praetarsi are absent; the setae of genua I and II are short; tarsi I to III do not exceed the tibia in length, and have 4 large, leaf-shaped setae; the dorsal setae of tarsi I consist only of a sensory rod and associated rod-shaped sensilla and 1 apical seta; tarsi IV are extremely short, ending in 2 long and 3 smaller simple setae.

To the genus Horstia belong 5 species, which are mainly found in the Tropics; those species of Horstia whose epimeres end freely (H. helenae Ouds., H. glabra Vtz.) have been placed by some authors in the genus Tortonia.

Horstia Ouds.

Hypopi

1(2) Large species (334μ); all the coxal fields are closed; end of sternal fork joined to epimeres II, and these, in their turn, with epimerites II, epimeres III with epimeres IV, the latter encircling a short sternum. On Xylocopa circumvolans Sm. Japan.

1. H. ornata Ouds.

2(1) Small species (165 to 180μ); all the coxal fields are open; epimeres II to IV, epimerites II and the sternum are free. On Xylocopa dissimilis Lep. and Platynopoda tenuiscapa Westw. Japan, India, Java.

2. H. helenae Ouds.

1. Horstia ornata Ouds. (Figs. 651, 652.)

Oudemans, 1900, Tijdschr. Entomol., XLII, 117, t. 6, Figs. 22 to 23. (Trichotarsus); 1905 Entomol. Ber., II, 21 (Horstia).

A large species. The idiosoma is 1.6 times longer than its width, gradually tapering from the shoulder region to the posterior edge; the lateral edges of the hysterosoma are straight over a great distance; v a are fairly long; p a are 20 to 22% of the length of the idiosoma; all the coxal fields are closed, the forked end of the sternum fusing with epimeres II, the latter in their turn with epimerites II, and epimeres III with epimeres IV, the last two also fuse with each other to form a short ventrum. The external suckers of the sucking disc are much smaller than the central ones and placed considerably anterior to them; the posterior ones are noticeably larger than the external (but considerably smaller than the central); they are much wider apart than the central and separated from them by a distance equal to their diameter. The leaf-shaped setae of tarsi I and II are very widely expanded, and may have a well-defined central ridge. Length 334μ, width 210μ.

Distribution. Japan (Kobe); on Xylocopa circumvolans Sm.

2. Horstia helenae Ouds. (Figs. 702, 703.)

Oudemans, 1902, Tijdschr. Entomol., XLV, 144, t. 12, Figs. 44 to 45 (Trichotarsus); 1905, Entomol. Ber., II, 21 (Horstia); ibid., III, 166 (Tortonia).

A small species. The idiosoma is a fairly regular egg-shape, 1.4 to 1.5 times longer than wide; the lateral edges of the hysterosoma are convex along their whole length; v a and p a are very short. All the coxal fields are open, epimeres II to IV, epimerites II and the sternum are free, not joined at their ends with each other; a ventrum is absent. The external suckers of the sucking disc are the same size as the central ones and are on a level with them; the posterior ones are slightly smaller than the external and separated from each other by about the same distance as the central ones, they are near the central ones. The leaf-shaped setae of the tarsi are noticeably narrower. Length 165 to 210μ, width 110μ.

Distribution. Japan, India, Java; on Platynopoda tenuiscapa Westw. and Xylocopa dissimilis Lep.

23. Genus Tortonia Ouds.

Oudemans, 1911, Entomol. Ber., III, 166.

Type species: Trichotarsus intermedius Ouds. 1901.

This is only known as the hypopus. The body is elongated, shaped like a pear or elongated hexagon and very convex (in T. intermedia) or flattened; the dorsal shields either cover the whole surface of the body or else are reduced, so that wide surfaces of a soft, sharply striated cuticle are left exposed; the setae of the dorsal surface vary in length, but sc e at least are represented by macrosetae. Eyes are absent.

The gnathosoma is quite distinct from the idiosoma and is only represented by arists. The sternum is simple and, likeepimeres II to IV, free; these epimeres are slightly bent and separated by a wide distance from each other, so thatall the coxal fields are widely open. The coxal and genital setae are microsetae. The sucking disc is small, with a membranous edge which projects beyond the edges of the body. The auxiliary suckers are sometimes well-developed.

The legs are of medium length, or fairly short; legs I to II have a small, slightly bent claw, which is absent from legs IV; the setae of genua I and II are short; tarsi I and II each have 3 lanceolate setae, a thin straight sensory rod and 1 large dorsal seta, also a cylindrical apical seta above the base of the claw and 1 simple ventral seta; tarsi IV terminate in a very long macroseta, 2 shorter setae and 1 or 2 very short ones.

The genus Tortonia has only been recorded from the Palearctic region; it contains 4 species (of which one - T. fluctuata - has been insufficiently described) which fall naturally into 2 groups, which I provisionally consider as subgenera.

Tortonia Ouds.

1(2) Idiosoma pear-shaped, strongly distended; all the dorsal surface is concealed by the dorsal shields, which have a pronounced pattern of "scales"; tarsi I and II long, thin, claws relatively long and thin; sc arranged in a transverse row; pseudostigmatic organ well-developed. On species belonging to the genera Osmia and Stelis. (Subgenus Tortonia s.str.) Germany, Switzerland, U.S.S.R. (near Leningrad, Siberia, Georgia).

1. T. intermedia Ouds.

2(1) Idiosoma elongated, hexagonal, flattened dorso-ventrally; dorsal shields only covering part of the dorsal surface (the peripheral regions are soft and membranous), with a faint longitudinal pattern;

tarsi I and II short and thick; claws short and large; sc i well anterior to sc e; pseudostigmatic organ absent. On species of the genus Anthidium. (Subgenus Donnadieuia subg.n.)

3(4) Sc i, h i, d_2. d_3 and both pairs of l_2 (l a and l p) are fairly long setae, 13 to 28% , sc e are exceptionally long, almost 45% of the length of the idiosoma, their ends extending beyond the base of l a; dorsal shields narrower, covering a small part of the dorsal surface of the idiosoma; posterior apical seta of tarsi IV shorter than the leg. On Anthidium septemdentatum Latr. Italy (Venice).

4. T. (D.) dogaressa sp.n.

4(3) Sc i, h i, d_1 to d_3 and l a and l p represented by microsetae which are scarcely visible; sc e of medium length (20 to 25% of the length of the idiosoma), their ends scarcely reaching the base of d_2; dorsal shields wider, covering a rather greater area of the dorsal surface of the idiosoma; posterior apical seta of tarsi IV more than twice as long as leg IV. On Anthidium sticticum F. Spain, Germany, Tunisia.

3. T. (D.) smitsvanburgsti Ouds.

1. Subgenus Tortonia s.str.

The body is pear-shaped and swollen, completely covered by both dorsal shields; the latter are covered with a reticulate pattern, in places resembling raised scales; sc are arranged in a transverse row; a large pseudostigmatic organ is present and the auxiliary suckers are well-developed; the legs are slender, with long tarsi and thin claws; the number of lanceolate setae arising from the legs is variable.

1. Tortonia (s.str.) intermedia Ouds. (Figs. 683 to 685.)

Oudemans, 1902, Tijdschr. Ned. Dierk. Ver. VII, 308, t. X, Figs. 49 to 50 (Trichotarsus); 1911, Entomol. Ber., III, 166 (Tortonia).

This is yellow-brown in colour. The body is 1.45 to 1.6 times longer than its width and narrows abruptly towards its slightly flattened posterior end; the propodosomal shield is 2.2 to 2.4 times shorter than the hysterosomal; sc e are smooth and straight, 20% of the length of the body, h e resemble them in structure, but are much shorter (12 to 14%); all the remaining dorsal setae are thin and capilliform, 4 to 8% of the length of the body. The legs are approximately 40 to 42 (I), 38 (II), 30 to 32 (III), 16 to 18 (IV) % of the length of the body; tarsi I and II are more than 3 times longer than their diameter at the base, with 3 large, but fairly narrow, lanceolate setae; on tarsi III there are 2 similar, large, leaf-shaped setae and 3 much smaller ones. Length 195 to 220μ, width 120 to 155μ.

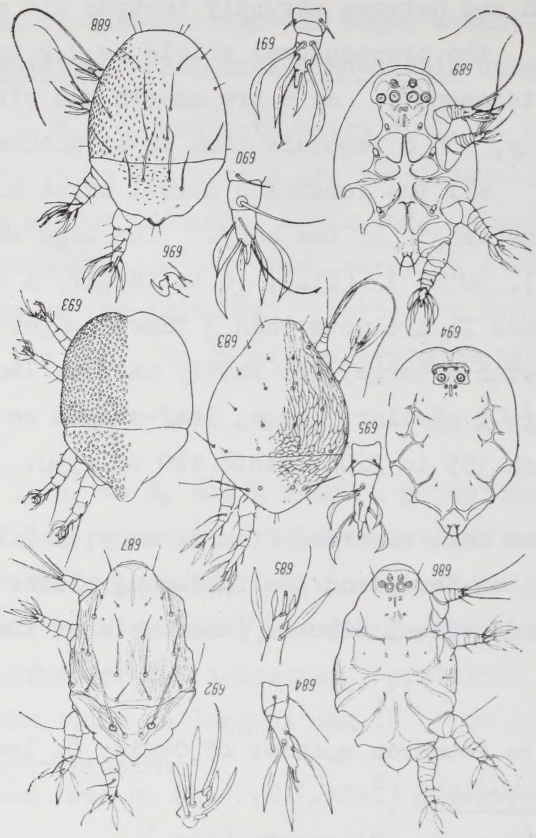
Distribution. It has been recorded from Germany; I have seen examples from Switzerland (Canton Vaud) and the following places in the U.S.S.R.: Lujsk in the Leningrad region, Siberia (the basin of the R. Nelkan), Georgia (Borjom).

Ecology. Hypopi were found on species of Osmia: O. leeana Kby., O. solskyi F.Mor., O. nigriventris (Zett.) Ny. and on nest parasites belonging to the genus Stelis (e.g. S. phaeoptera Latr.).

2. Tortonia (s.str.) fluctuata Ouds.

Oudemans, 1917, Entomol. Ber., IV, 391.

Hypopus. This is unknown to me. Length 186μ, width 122μ. It differs from T. intermedia in the following characters: legs I and II are longer; there is a more darkly coloured keel on the posterior end of the body; tarsi I and II have only 1 lanceolate seta each, tarsi III have none; the sucking disc is small and does not protrude beyond the posterior edge of the body, it has 10 suckers. On Bombus proteus Gerst. ver. tricolor Alfk. Germany (Bremen), according to Oudemans.



Figs. 683 - 696. Hypopi of the genera Tortonia, Neohorstia and Cerophagus

Fig. 683 - Tortonia intermedia Ouds., dorsal surface. Fig. 684 - T. intermedia Ouds., tarsus I, ventral view. Fig. 685 - T. intermedia Ouds., tarsus III, ventral view. Fig. 686 - T. smitsvanburgsti Ouds., ventral surface. Fig. 687 - T. dogaressa, sp.n., dorsal surface. Fig. 688 - Neohorstia mamillata, sp.n., dorsal surface. Fig. 689 - Ditto, ventral surface. Fig. 690 - Ditto, leg I, dorsal surface. Fig. 691 - Ditto, tibia and tarsus I, ventral surface. Fig. 692 - Ditto, tarsus IV, dorsal surface. Fig. 693 - Cerophagus granulatus Duj., dorsal surface. Fig. 694 - Ditto, ventral surface. Fig. 695 - Ditto, tarsus I, ventral surface. Fig. 696 - Ditto, end of tarsus IV.

2. Subgenus Donnadieuia subg.n.

The body is an elongated and flattened hexagon; the dorsal shields cover only the central part of the dorsal surface of the body, leaving exposed large areas of membranous and coarsely striated cuticle; it is faintly ornamented in the usual way; sc are arranged in the shape of a trapezium; a pseudostigmatic organ is absent; auxiliary suckers are feebly developed; the legs are short and thick, with short tarsi and thick, almost conical claws; tarsi I and II have 3, tarsi III 5 widely lanceolate setae. This subgenus contains 2 species, biologically connected with Anthidium sp.

3. Tortonia (Donnadieuia) smitsvanburgsti Ouds. (Fig. 705.)

Hypopus. The body is pale in colour, 1.6 to 1.7 times longer than wide; its dorsal surface is fairly well covered by the dorsal shields, which are slightly pigmented. Sc e are 23 to 25% of the length of the body, they are flexible and slightly flattened, their distal ends extending to the bases of d_1; h e are 15 to 16% of the body in length; all the remaining setae of the dorsal surface are short and thin. The legs are about 30 to 31 (I, II), 23 (III), 16 to 18 (IV)% of the length of the body; tarsi I and II in length do not exceed twice their diameter at the base, each bears a capilliform ventral seta at equal distances from the base and apex of the segment; on tarsi IV the posterior (third) long seta exceeds the length of the leg. Length 230 to 280μ, width 140 to 175μ.

Distribution. Tunis; I have also found it in Algeria and Spain. The hypopus has only been found on Anthidium sticticum F.

4. Tortonia (Donnadieuia) dogaressa sp.n. (Fig. 687.)

Hypopus. This is allied to the preceding one. The dorsal shields occupy a still smaller region, so that wide portions of membranous striated cuticle are left exposed. Sc e are exceptionally long (about 45%

of the length of the body), their distal ends extending beyond the base of l a; h e are 20 to 22%, sc i, h i, d_1 to d_3, l a and l p are fairly long (13 to 18%), and slightly flattened, like sc e and h e; d_1 and both pairs of sa are represented by microsetae. The ventral setae of tarsi I and II are displaced to the base of the tarsus; the third (posterior) long seta of tarsi IV is shorter than the legs and is noticeably thickened. Length 175 to 220μ, width 120 to 145μ.

Distribution. N. Italy: near Venice. It is biologically connected with the bee Anthidium septemdentatum Latr. on which these hypopi were found in large numbers.

24. Genus Neohorstia gen.n.

Type species: Neohorstia mamillata sp.n.

This is only known in the hypopial form. The body is egg-shaped and fairly convex; the dorsal shields cover the whole of the dorsal surface, they are thick and coarsely patterned with deep circular pits arranged in lines running parallel with the edges of the body; the spaces between the lines are also finely pitted; at the apex of the rostrum is the eye, this is composed of retinae fused internally and strongly sclerotised and pigmented. The setae of the dorsal surface are very long, the longest (sc, h i, d_1 to d_3 and l a) are slightly flattened. The gnathosoma is better developed than in other genera of the subfamily Chaetodactylinae and is a short plate, split along the mid-line and bearing distally a pair of distinct cylindrical segments, each ending in an arist. The sternum is bifurcated like a T at its end; epimeres II are sharply bent and almost touch the stout epimerites II with their ends, so that coxal fields II are almost closed; epimeres III are similarly bent and therefore almost close the corresponding coxal fields; the ends of epimeres IV are bent posteriorly and extend almost as far as the genital slit; the lateral thickenings of all the coxal fields are very wide. The coxal

and genital setae are modified to form massive, short-stalked, ovoid structures and are placed on the lateral thickenings of the coxal shields. The sucking disc is large, without a free membranous edge and with 4 pairs of suckers.

The legs are medium in length and fairly massive, all have small, slightly hooked immovable claws, without a fleshy praetarsus; the setae of genua I and II are also medium in length; tarsi I and II have 5 lanceolate, large setae, III have 4 narrower ones and 3 similar setae are also present on tarsi IV; tarsi III also have a fairly long macroseta; tarsi IV are equal in length to the sum of the 2 preceding segments, and have 2 long macrosetae.

Only 1 species is known.

1. Neohorstia mamillata sp.n. (Figs. 688, 692.)

Hypopus. This is whitish in colour, with a faint yellowish tinge, which is more obvious in the posterior third of the dorsal surface. The body is 1.4 to 1.5 times longer than its width, with a shallow, rounded, posterior end, which is slightly blunted and flattened. The propodosomal shield is rather less than half the hysterosoma in length; sc e are very long, flexible and flattened, 30% of the length of the body and 1.5 times as long as sc i; h i, d_1 to d_3 and l a are about 17 to 20% of the body in length and similar in structure to sc; h e, d_4, l p and sa are thin, capilliform setae. The sclerotised plate of the sucking disc is divided into 3 distinct oval plates. The tarsi are short and thick, I and II are only 1.5 times longer than their diameter at the base; Tarsi III and IV are scarcely longer than the diameter at the base; the sensory club of tarsi I and II is straight, gradually narrowing towards the end. Length 200 to 262μ, width 144 to 180μ.

Distribution. Greece (Attica), Iran (Hadji-Abad). The hypopus was found on Anthidium pubescens F.Mor. (Iran) and A. laticeps F.Mor. (Greece).

25. Genus Cerophagus Ouds.

Oudemans, 1904, Tijdschr. Entomol. XLVI, 12.

Type species: Hypopus granulatus Duj. 1849.

This is only known as the hypopus. The body is widely egg-shaped and fairly concave, with an indented posterior edge; the dorsal shields cover the entire dorsal surface and posteriorly are reflected on to the ventral side; they are very massive, with an exceptionally sharp and uniform pattern, consisting of clearly defined, round or oval indentations, these penetrate the whole thickness of the cuticle (like the holes in a sieve); the walls between the indentations are also finely pitted. The setae of the dorsal surface are small, indistinct microsetae. Eyes are absent. The gnathosoma is feebly defined, consisting of a pair of shallow, circular segments ending in strong arists. The sternum is simple and, like the epimeres, free; all the coxal fields are open, separated along the mid-line of the body by a very wide central field; epimerites II are joined to epimeres III and give rise to an anteriorly-directed projection. The coxal and genital setae are small and thin. The sucking disc is small, square and considerably removed from the posterior edge of the body; both posterior suckers project from a distinct, semicircular plate; the apodeme of the sucking disc is longitudinal.

The legs are equally developed, fairly slender, with large recurved claws; the praetarsi are thick, with a ventral tooth-shaped projection; tarsi I and II have 5, and the remaining tarsi 4, comparatively large, lanceolate setae; tarsi III and IV have no macrosetae and tarsi I has also 13 setae. A monotypical genus.

1. Cerophagus granulatus Duj. (Figs. 693 to 696.)

Dujardin, 1849, Ann. Sci. Nat. Zool., (3), XII, 253, 255 (Hypopus). - bomborum Oudemans, 1902, Entomol. Ber., I, 20 (Glycyphagus); 1904, Tijdschr. Entomol., XLVI, 14, t. 2, Figs. 29 to 30. - gracilis Vitzthum 1912, Ztschr. wiss. Insektenbiol., VIII, 292, Fig. 23 (Cerophagus).

Hypopus. Whitish in colour, with a brown posterior edge. The body is 1.5 times longer than its width; the propodosomal shield is triangular, only one-third shorter than the hysterosomal, with almost straight lateral edges, which converge anteriorly at a rounded acute angle; for a considerable distance, the lateral edges of the hysterosoma are almost parallel with one another; the posterior edge is widely rounded, but has a fairly deep incision in the middle. The pseudostigmatic organ is well-developed. The lateral suckers are posterior to the large central ones, and are equal to the posteriors, with which they form a straight transverse row. The legs are 32 (I, II), 30 to 31 (III), 29 to 30 (IV) % of the length of the body; their separate segments are similar in thickness and have the same proportions; the tarsi are 2.3 to 2.5 times longer than their diameter at the base, becoming narrower towards their distal ends; the sensory rod of tarsi I and II is long, almost straight, barely thickened at the end. Length 195 to 220μ, width 130 to 150μ.

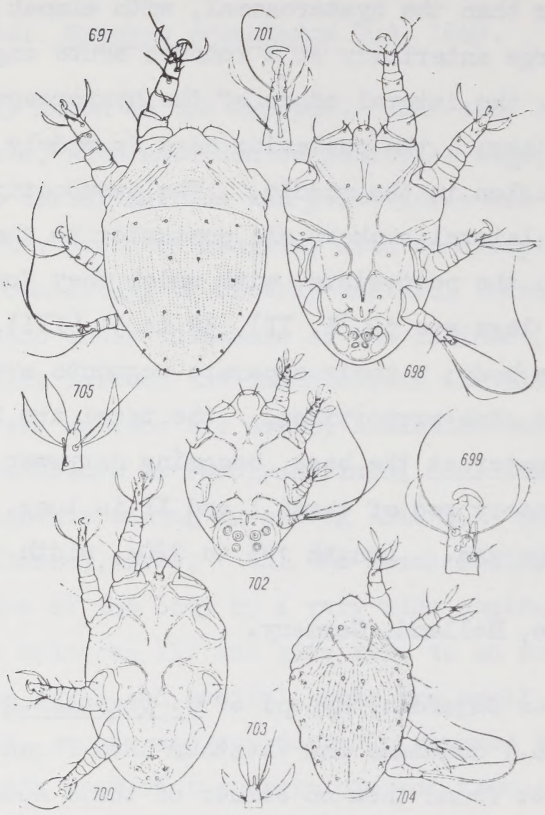
Distribution. France, Holland, Germany.

Ecology. According to Dujardin, hypopi of C. granulatus are often found on Bombus lapidarius L.; Oudemans and Vitzthum have found them on B. terrestris L. I have not found them on either of these species of bumble bee, but only on B. argillaceus (Scop.) Schmdkn.

26. Genus Cerophagopsis gen.n.

Type species: C. skorikovi sp.n.

This is only known as the hypopus. The body is elongated and egg-shaped, regularly narrowing towards a rounded posterior end; the dorsal shields cover almost the whole of the dorsal surface of the body, they are moderately thick and ornamented with typical thin indentations, which run diagonally and transversely on the propodosomal shield, mainly longitudinally on the hysterosomal; all the setae of the dorsal surface are



Figs. 697 - 705. Hypopi of the genera Horstia, Sennertionyx and Cerophagopsis

Fig. 697 - Sennertionyx manicati Giard. Dorsal surface. Fig. 698 - Ditto, ventral surface. Fig. 699 - S. manicati Giard, tarsus I, dorsal surface. Fig. 700 - Cerophagopsis skorikovi, sp. n., ventral surface. Fig. 701 - Ditto, tarsus I, dorsal surface. Fig. 702 - Hostia helenae Ouds., ventral surface. Fig. 703 - Ditto, tarsus I, dorsal view. Fig. 704 - Tortonia smitsvanbergsti Ouds., dorsal surface. Fig. 705 - Ditto, tarsus I, dorsal surface.

uniformly thin microsetae. No eyes are present. The gnathosoma consists of a pair of closely apposed protrusions, bearing fairly long arists. The coxal-sternal skeleton resembles that found in the genus Sennertionyx, but the sternum is not forked, and the lateral thickenings of the coxal fields have an undulating outline and are not interrupted in the middle. The coxal and genital setae are thin microsetae. The sucking disc is small, without a free membranous edge; the apodeme of the sucking disc is absent. The legs are fairly long, III and IV being slightly shorter than the anterior ones, but almost the same thickness; all have fairly long, sharply bent claws, which are slightly twisted spirally; tarsi I to III have 3, tarsus IV has 2 sickle-shaped setae; III and IV have no macrosetae. Only 1 species is known.

1. Cerophagopsis skorikovi sp.n. (Figs. 700, 701.)

Hypopus. A pale yellow in colour. The body is 1.4 to 1.5 times longer than its width and the propodosoma is about 2.5 times shorter than the hysterosoma. The sucking disc is round; the lateral suckers are arranged on the same transverse line as the central ones, and are much smaller, whilst the posteriors and laterals are equal in size; posteriorly, the sclerotised plate of the disc is divided into 3 regions, with somewhat angular outlines. The front legs are much longer, but barely thicker than the posterior ones; tarsi I and II are twice, III and IV 1.5 times longer than their diameter at the base; the sensory rod of tarsi I and II is slightly bent, noticeably expanded at the end. Length 220 to 285μ, width 150 to 185μ.

Distribution. Japan (Kioto). The hypopi were found in large numbers on Megachile döderleini Fr.

27. Genus Sennertionyx gen.n.

Type species: Trichotarsus manicati Giard 1900.

Only known as the hypopus. The body is elongated and egg-shaped, moderately convex; the dorsal shields cover almost all the dorsal surface, leaving exposed only a narrow strip of feebly striated cuticle. The surface of the dorsal shields is covered with a faint pattern, similar to that found in most Saproglyphidae; all the setae of the dorsal surface are the same: thick, smooth microsetae. No eyes are present, and the gnathosoma is completely fused with the idiosoma and only represented by short arists. The sternum is forked at the end and free; epimera II are strong, sharply bent, their ends almost touching the short anteriorly directed projections from epimeres III; epimerites II are fused with epimeres III, the ends of the latter with epimeres IV; epimeres IV are also directed posteriorly and gradually converge, almost as far as the genital slit; thus all the coxal fields, except I, are closed and encircle an elongated cetnral field, which is only open at the front end; the lateral thickenings of the coxal fields are clear, but fairly narrow and interrupted in the middle. The sternal and coxal setae are represented by thin microsetae. The sucking disc is of medium size, with a membranous edge, which protrudes slightly beyond the edge of the body; from it project the usual 4 pairs of suckers.

Legs I to III are very strong, with large spirally twisted claws, which are inserted on the end of a conical soft praetarsus; legs IV are much shorter and thinner than the others, with small hooked claws; tarsi I to III have 3 large, crescentic setae; tarsi IV have no distally widened setae, but 1 very long macroseta and several shorter ones. Only 1 species belongs to this genus.

1. Sennertionyx manicati Giard. (Figs. 697 to 699.)

Giard, 1900, Bull. Soc. Entomol. Fr. 375 (Trichotarsus); Oudemans, 1905, Entomol. Ber., II, 21; Vitzthum, 1919, Arch. Naturg., LXXXV, 5: 30 (Horstia)

Hypopus. A light yellow brown in colour. The body is 1.5 times longer than wide, with a rounded posterior end. The propodosomal shield is al-

most 2.5 times shorter than the hysterosomal; sc are arranged at the corners of a transversely elongated rectangle. The lateral suckers are almost the same size as the central ones; they are anterior to the central ones and form, with them, an anteriorly concave arc; the sclerotised plate of the sucking disc is divided into 3 independent oval regions. The legs are: 40 (I), 37 to 38 (II), 30 (III), 20 to 23 (IV) % of the idiosoma in length; tarsi I and II are slightly less than twice as long as their diameter at the base, III and IV are almost the same length. Length 210 to 260μ, width 135 to 170μ.

Distribution. This species has been found in France. I have only once found it in Andalusia, a part of Italy, Corfu and the following places in the U.S.S.R.: near Odessa, in Georgia (Borjom), Armenia, Kopetdag (Kelte-Chenar), N.W. Kazahstan (Borovsk forestry commission).

Ecology. S. manicati is biologically connected with species of Anthidium; the hypopi were found on A. manicatum L., A. florentinum F., A. diadema F., A. oblongatum Latr. and A. cingulatum Latr.

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